

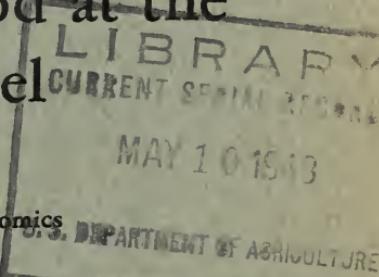
Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Feed Consumption by Livestock 1910-41

Relations between feed,
livestock, and food ~~at the~~
national level

R. D. JENNINGS
Bureau of Agricultural Economics



UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C., 1943



ACKNOWLEDGMENTS

Data for this study of the feed supply and its utilization were derived from several sources. Acknowledgment is made to those members of the staff of the Bureau of Agricultural Economics who assisted in obtaining data and in their interpretation.

April 1943 • Washington, D. C.



UNITED STATES DEPARTMENT OF AGRICULTURE

Feed Consumption by Livestock, 1910-41

BY R. D. JENNINGS, *Senior Agricultural Economist, Bureau of Agricultural Economics*

CONTENTS

	Page
Introduction	1
The national feed supply	3
Long-time changes	3
Changes in feed supplies since 1928	5
Feed consumption expressed in feed units	10
Use of feed units as a measure of nutritive value	10
Feed units used in 1929-33 and 1938-40	14
Livestock production, 1910-41	15
Changes in different kinds of livestock	15
Effect of decline in number of horses on use of feed	16
Animal or feed-consuming units of livestock	20
Utilization of feed	20
Percentage use of feed by livestock, 1938-40	20
Long-time changes in use of feed	20
Changes in efficiency in use of feed	21
Quantitative distribution of feed to livestock, 1910-41	21
The protein situation	31
Efficiency of livestock in converting feed into human food	40
Uses that can be made of data concerning feed utilization	42
Estimating the grain and other concentrates required for livestock in the United States	46
Other uses for data	52
	54

INTRODUCTION

Feed for livestock suddenly becomes of crucial importance in meeting the crucial needs of the United Nations for food. For 10 years the emphasis of agricultural leaders has been on holding down the overabundant supplies of feed and keeping the fertility in the soil against a time of need. That time is here and now. Milk, meat, eggs, must be produced in quantities never before attempted. Production of feed is the principal occupation of many farmers and is of at least secondary importance on most other farms. How this feed is produced and utilized is now of prime concern.

In answering the question as to how much more feed is needed to produce a given quantity of milk or hogs or eggs, it is necessary to know how much feed of the different kinds it takes to produce 100 pounds of milk, hogs, or a dozen eggs under average conditions. When the total quantity of feed needed is known, it is then possible to ascertain whether the goals of livestock production are realizable, and to determine changes in the production of feed and in feeding practices that will facilitate the attainment of the desired goals.

The principal contribution of this circular to this problem is found in the data on feed consumption per unit of livestock which is given in several tables. The data on livestock numbers and livestock production and feed production used in arriving at the rates of feed consumption in these tables are the official estimates of the Department of Agriculture insofar as they are available. The data used herein are averages for the United States and are thus made up of information that is representative of a variety of conditions which may differ widely

from the average in feed requirements for a particular product. Beef cattle in the Southwest, for instance, get almost all their feed from grass; in the East much hay and corn fodder are fed, and some grain; in Corn Belt feed lots, cattle get a heavy feed of corn. Dairy cows in the East get a heavy grain ration; in the West less grain and more hay are fed. These data therefore are not applicable as they stand in any one region, State, or smaller territory, and this is especially true of the data for cattle and sheep. Utilization of the feed resources of the country at the national level is considered here.

The word "feed" includes the grass obtained from pasture and range lands as well as concentrates, hay, and other roughages. "Pasture" as used in this report includes the grazing obtained from range lands as well as farm pastures.

The data presented as to the utilization or consumption of feed by different classes of livestock are approximations rather than mathematically exact averages. The data on feed requirements found in the reports of the many studies made in widely scattered parts of the country in the last 25 years were the most valuable source of information, but, in addition, fragments of information from many sources were used in arriving at conclusions. This report is an attempt, therefore, to rationalize all the information available on the problem.

Two devices used occasionally here should be understood at the outset—the *feed unit* and the *animal unit* of livestock. The feed unit is the common denominator for all kinds of feeds, including pasture and range and is equal in feeding value to 1 pound of average corn. The total digestible nutrients could have been used for the common measure of all kinds of feed, but this tends to put too high a value on roughage and too low a value on high-protein feeds when they are fed in limited quantities. The feed unit is a somewhat arbitrary measure, but it seems to be fairly satisfactory when a common measure is wanted of all kinds of feeds. It has the advantage of being easily understood, as corn is the best-known feed. If it is desired to convert feed units into total digestible nutrients 1 pound of corn or feed unit is equal to 0.8 pound of total digestible nutrients.

A description of the methods used will be supplied to any worker upon request addressed to the Bureau of Agricultural Economics.

The dairy cow is the usual unit of measure to which other animal numbers are converted when it is necessary to have a measure of all animals combined. The number of animal units is usually thought of as the livestock on hand at a particular time or kept for a given length of time equivalent in feed requirements to a given number of dairy cows. In this report the feed requirements of a milk cow for 1 year are taken as an animal unit and the other classes of livestock have been converted to animal units on the basis of feed requirements for a year; that is, an animal unit of hogs uses as many feed units in 1 year as the average milk cow uses in 1 year. The feed requirement of an average milk cow happens to be nearly 5,000 feed units or 4,000 pounds of total digestible nutrients. Thus, the production of 1,000 pounds of hogs, which requires nearly 5,000 feed units, would be about 1 animal or feed-consuming unit. During a year the feed consumed per head of all cattle other than milk cows on hand January 1 is about 70 percent as much as that consumed by a milk cow. There-

fore 1 head of other cattle on January 1 is 0.70 animal unit. This applies to the United States as a whole and would not necessarily be true for a region, State, or smaller area.

THE NATIONAL FEED SUPPLY

LONG-TIME CHANGES

The total quantity of feed nutrients (expressed in feed units) used by all kinds of livestock in the United States in 1940 was probably only a little larger than the quantity used 30 years earlier. It was probably a little less than during the period 1916-24 when the largest quantity of feed consumed by livestock during the 30-year period was reported. Around 90 million tons of grain and almost as much hay was fed annually over this period (table 1).

TABLE 1.—*Feeds (excluding pasture) fed to livestock in the United States, 1910-41*¹

Calendar year	Corn ²	Oats	Other grains ³	All grain ²	Other concentrates ⁴	Corn silage ⁵	Hay	Other dry roughage ⁶
	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
1910	65,867	14,511	2,482	82,860	—	—	84,442	—
1911	68,609	15,031	3,089	86,729	—	—	73,199	—
1912	65,832	14,695	4,102	84,629	—	—	72,410	—
1913	68,216	17,413	4,032	89,661	—	—	79,463	—
1914	60,029	16,150	3,432	79,611	—	—	81,121	—
1915	64,724	15,090	4,926	84,740	—	—	84,360	—
1916	67,403	17,599	5,738	90,740	—	—	93,053	—
1917	63,214	16,374	4,341	83,929	—	—	95,047	—
1918	68,455	18,296	5,494	92,245	—	—	86,209	—
1919	5,358	17,893	6,813	90,064	—	—	86,619	—
1920	69,766	16,642	6,243	92,651	—	27,318	88,895	—
1921	73,991	17,578	6,955	98,524	—	27,588	87,064	—
1922	74,006	15,899	6,295	96,200	—	27,214	92,435	—
1923	72,343	16,790	6,858	95,991	—	28,491	92,243	—
1924	71,093	18,082	5,053	94,228	—	29,419	90,136	—
1925	61,145	19,290	6,590	87,025	—	28,979	87,006	—
1926	68,093	18,700	5,490	92,283	—	29,802	80,426	—
1927	68,545	16,317	7,344	92,206	—	30,266	82,512	—
1928	68,747	16,591	8,907	94,245	—	29,955	91,126	—
1929	64,608	17,262	9,785	91,655	—	29,734	88,256	—
1930	59,273	16,423	10,388	86,084	7 15,184	29,727	83,046	7 28,978
1931	55,394	17,380	12,734	85,508	—	31,455	75,412	—
1932	68,135	15,793	12,527	96,455	—	31,570	76,565	—
1933	71,364	14,300	10,698	96,362	—	31,958	80,042	—
1934	54,308	9,145	6,039	69,492	—	33,343	72,647	—
1935	45,385	10,346	6,129	61,860	—	34,592	69,170	—
1936	53,431	15,551	8,150	77,132	—	33,541	79,791	—
1937	46,671	13,508	7,617	67,796	—	33,544	77,298	—
1938	57,935	15,300	9,371	82,606	—	34,551	79,945	—
1939	61,471	14,939	9,884	86,294	8 16,826	32,672	88,623	8 33,204
1940	62,406	15,200	9,810	87,416	—	32,501	91,140	—
1941	63,475	17,716	12,444	93,635	—	34,113	93,629	—

¹ Includes grains or other feed materials fed as such or used in mixed feeds. Where data are omitted, no estimate was available. Revisions in data since July 1942 not included.

² Includes corn in silage. The corn in silage is also included in the tonnage of silage in column 6 and amounts to about 12 percent of the silage tonnage.

³ Includes barley, wheat, and other grains fed.

⁴ Includes oil meals, tankage, bran, soybeans, and other feeds listed in tables 5 and 6.

⁵ From 1920 to 1940 it was assumed that 40 percent of the production was fed in the year produced and 60 percent in the following year. No official estimate was available for 1910-19. Production in 1910 was probably around one-third to one-fourth of what it was in 1940. See footnote 2 also.

⁶ Includes an estimate of corn stover, sorghum forage, and other roughage shown in table 7.

⁷ 5-year average, 1929-33.

⁸ 3-year average, 1938-40.

The lowest quantity of feed fed in any 4-year period was during the years 1934-37 when only three-fourths of the normal quantity of grain was fed, and when the production of hay and pasture was also much reduced as a result of the great droughts of 1934 and 1936. The supply of feed in 1930 and 1931 was reduced by the drought of 1930 but to a lesser extent than by the later droughts.

Less corn was fed in 1940 and 1941 than was considered normal before 1930. Somewhat fewer oats were fed but more barley and wheat, especially when compared with the first half of the 30-year period. Corn silage was little used before 1910, but its use increased greatly from 1910 to 1920. Probably three times as much was produced in 1920 as in 1910. Since 1920, use of corn silage has increased along with the increase in numbers of milk cows.

The production and use of hay have varied considerably from year to year. The tonnage used in 1941 was higher than that used in any year since 1917. The total tonnage of hay and silage fed in 1941 is the highest on record, although the number of roughage-consuming animal units is not so high as it was 20 years ago.

The many byproduct feeds are an important contribution to the feed supply (table 2). Chief of these are wheat millfeeds, cottonseed meal, and soybean oil meal. The latter has been increasing in importance in recent years.

TABLE 2.—*Consumption of specified high-protein feeds, wheat millfeeds, and other feeds¹*

Crop year	High-protein feeds (plant)						Animal-protein feeds																													
	Cottonseed meal and cake ²			Linseed meal and cake			Soybean oil meal			Peanut oil meal and cake			Copra meal			Gluten meal and feed			Total of 6 plant-protein feeds			Tallow and meat			Skim milk			Fed on farms where produced ⁴			Dried and fed to livestock			Total of animal-protein feeds		
	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons						
1919-20																																				
1920-21																																				
1921-22																																				
1922-23																																				
1923-24																																				
1924-25																																				
1925-26																																				
1926-27	2,118	426	32	10	87	645	3,318																													
1927-28	1,664	493	61	22	95	703	3,038																													
1928-29	1,859	439	91	18	110	702	3,219	445	120	1,638	42	2,245	5,221																							
1929-30	1,980	368	114	35	110	647	3,254	433	111	1,580	52	2,176	5,128																							
1930-31	1,837	334	123	18	96	541	2,949	428	118	1,667	52	2,262	5,246																							
1931-32	1,753	204	133	14	75	511	2,600	418	117	1,727	54	2,316	4,631																							
1932-33	1,675	202	113	17	95	590	2,692	449	142	1,774	58	2,423	4,482																							
1933-34	1,679	142	99	11	117	577	2,625	473	184	1,660	59	2,376	4,298																							
1934-35	1,504	202	285	47	112	444	2,596	355	190	1,594	55	2,194	4,490																							
1935-36	1,725	263	633	48	128	588	3,385	449	265	1,533	63	2,310	4,669	91	220	226																				
1936-37	1,995	273	552	67	137	511	3,535	434	264	1,463	64	2,225	4,942	108	259	295																				
1937-38	2,367	177	740	50	118	545	3,997	412	220	1,568	80	2,280	4,493	109	156	246																				
1938-39	2,014	203	1,042	75	129	567	4,030	479	266	1,594	70	2,409	4,701	103	149	339																				
1939-40	1,870	393	1,299	38	179	614	4,393	546	220	1,577	80	2,423	4,852	104	160	286																				
1940-41	1,810	740	1,526	137	174	759	5,146	590	260	1,586	54	2,490	4,902	106	191	322																				
1941-42	1,723	891	1,825	67	79	962	5,547	600	180	1,454	20	2,254	4,800	142	295	272																				

¹ Most of these data are reported in the Feed Situation, B. A. E.

² Production plus imports minus exports. Cottonseed meal for fertilizer excluded.

³ Production in wholesale plants only.

⁴ Dry equivalent.

CHANGES IN FEED SUPPLIES SINCE 1928

Some changes in the supply of feed are shown in table 3. The periods compared are 1938-40 and 1929-33.¹ The changes indicated have been brought about by the agricultural adjustment programs, by the reduction in numbers of horses, and by the great droughts of 1934 and 1936.

TABLE 3.—*Quantity of grains, concentrates, and semiconcentrated feeds consumed annually by livestock, 1929-33 and 1938-40¹*

Item	1929-33		1938-40	
	Quantity	Proportion of total	Quantity	Proportion of total
Grains: ²				
Corn ³	1,000 tons	Percent	1,000 tons	Percent
Oats	60,096	58.2	54,219	57.2
Barley	16,686	16.2	14,532	15.3
Grain sorghums	5,035	4.9	3,344	3.5
Other grain ⁴	1,688	1.6	1,648	1.7
Total	4,563	4.4	4,271	4.5
	88,068	85.3	78,014	82.2
Commercial feed materials: ⁵				
High-protein concentrates	3,562	3.5	4,869	5.1
Medium-protein concentrates	5,192	5.0	4,942	5.2
Low-protein concentrates	1,478	1.4	1,461	1.6
Total	10,232	9.9	11,272	11.9
Miscellaneous feeds: ⁶				
Miscellaneous beans and seeds fed whole	1,859	1.8	2,551	2.7
Skim milk, etc. (dry equivalent)	1,784	1.7	1,683	1.8
Other feeds	1,309	1.3	1,320	1.4
Total	4,952	4.8	5,554	5.9
Grand total	103,252	100.0	94,840	100.0

¹ Includes grains or other feed materials fed as such or used in mixed feeds. The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period July 1, 1937, to June 30, 1940. See footnote 1, p. 5 for reasons for using these periods.

² See table 4 for derivation.

³ Includes corn hogged- or grazed-off but not corn in silage. The quantity of corn, including the corn in silage, was 63,661 tons in 1929-33 and 58,448 tons in 1938-40.

⁴ Includes wheat fed on the farms where grown but no estimate of wheat fed on other farms. Also includes rye and other grains.

⁵ See table 5.

⁶ See table 6.

FEED GRAINS

Average annual consumption of feed grains (including wheat) by livestock in the 3 years 1938-40, was 89 percent of the average annual consumption in the 5-year period 1929-33. The quantity of corn fed to livestock was reduced about 10 percent, oats 13 percent, barley 33 percent, grain sorghums 2 percent, and other grains about 6 percent.

¹ The exact periods compared are the 5-year period July 1, 1928, to June 30, 1933, and the 3-year period July 1, 1937, to June 30, 1940. The year beginning July 1 was used rather than the calendar year because it conforms more nearly to the crop year than does the calendar year, which, insofar as consumption of feed is concerned, includes parts of 2 crop years. Livestock production is reported on a calendar-year basis. The production of livestock was estimated for the half year at the beginning and end of both the 5-year and 3-year periods at one-half the annual production for that year. The error involved in this estimate is spread over the 5-year and 3-year periods and is probably small.

The annual feed-consumption data in this circular are shown on a calendar-year basis because that is the period used in estimating production of livestock. It was decided that less error was probable in a single year in estimating feed disappearance for a calendar year than in estimating production of livestock for a crop year. It would be desirable from the standpoint of estimating consumption of feed to have an annual estimate of livestock production that conforms to the crop year beginning July 1 or October 1.

In the 1929-33 period the average production of corn, excluding silage, was 2,426 million bushels (table 4). In the years 1938-40, the production of corn was about 1 percent larger than it was in the earlier period, but there was a large inventory at the end of 1940 in the Ever-Normal granary. In the second period, slightly less corn was used for seed but more was exported and used for human food or in industry. The last three uses accounted for about 8 percent of the production in the first period and 10 percent in the second period.

The production of oats was 13 percent less in the period 1938-40 as compared with 1929-33. Less oats was used in the second period than in the first for seed, for human food, in industry, or for export. Production of barley was reduced 11 percent, but a large increase in industrial uses took place as a result of the repeal of the prohibition amendment. More than 5 million bushels of barley a year went into alcohol and distilled spirits compared with less than a million bushels in the first period. About 26 percent of the barley produced went for human food or into industry in the second period, compared with about 8 percent in the earlier period. This accounts for the large reduction in barley fed to livestock.

No striking changes took place in the utilization of grain sorghums and no significant changes occurred in the quantity of other grains fed to livestock, of which wheat is the principal item.

TABLE 4.—Average annual utilization of feed grains, 1929-33 and 1938-40¹

Item	Corn	Oats	Barley	Grain sorghums	Other grain ²
<i>July 1, 1928-June 30, 1933</i>					
Production	1,000 bushels ³ 2,426,223	1,000 bushels 1,215,102	1,000 bushels 281,237	1,000 bushels 61,084	
Used for seed	18,885	97,397	24,252	801	
Net exports	12,170	4,337	20,457		
Used for human food and industry	170,752	46,870	22,784		
Increase in inventory ⁴	78,130	23,648	3,942		
Total	279,937	172,252	71,435	801	
Fed to livestock	2,146,286	1,042,850	209,802	60,283	
Fed to livestock	1,000 tons 60,096	1,000 tons 16,686	1,000 tons 5,035	1,000 tons 1,688	1,000 tons 4,563
<i>July 1, 1937-June 30, 1940</i>					
Production	1,000 bushels ³ 2,457,633	1,000 bushels 1,055,328	1,000 bushels 249,366	1,000 bushels 59,840	
Used for seed	16,273	86,625	24,944	977	
Net exports	56,526	4,008	10,115		
Used for human food and industry	180,341	37,500	64,241		
Increase in inventory ⁵	268,088	18,933	10,752		
Total	521,228	147,066	110,052	977	
Fed to livestock	1,936,405	908,262	139,314	58,863	
Fed to livestock	1,000 tons 54,219	1,000 tons 14,532	1,000 tons 3,344	1,000 tons 1,648	1,000 tons 4,271

¹ Livestock on farms and in towns and cities. The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933 and for the 3-year period July 1, 1937 to June 30, 1940. See footnote 1, p. 5 for reasons for using these periods.

² Wheat, rye, and other grains fed to livestock.

³ Corn for grain, corn hogged- or grazed-off and fed in the shock (excludes corn in silage).

⁴ Stocks July 1, 1933 - July 1, 1928 \pm 5.

⁵ Stocks July 1, 1940 - July 1, 1937 \pm 3.

Corn is the chief feed grain fed to livestock, making up 68 percent of the total tonnage of grains in 1929-33 and 70 percent in 1938-40,

excluding the corn in silage. Oats made up 19 percent of the grains fed in the first period and slightly less in the second period. Barley accounted for less than 6 percent in the earlier period and about 4 percent in the second period. Grain sorghums accounted for only about 2 percent of the total grains, and other grains accounted for about 5 percent in both periods. Corn has decreased in quantity but has increased slightly in relative importance as a source of feed, between these two periods.

OTHER CONCENTRATES

Feed grains accounted for only 85 percent of the tonnage of concentrated feeds fed to livestock in the period 1929-33 and about 82 percent in 1938-40. The remainder was made up of commercial feed materials, seeds and beans fed whole, skim milk, and a few minor items.

COMMERCIAL FEED MATERIALS.—The most important of the other concentrated feeds are the commercial feed materials, consisting of the various oil meals and the byproducts of milling, slaughtering, and other industries. Taken together they accounted for 10 percent of the total tonnage of concentrates in 1929-33 and about 12 percent in 1938-40. From a feeding standpoint they are of more significance than this indicates, for this group contains the high-protein concentrates.

TABLE 5.—*Quantity of specified commercial feed materials consumed annually by livestock, 1929-33 and 1938-40*¹

Item	1929-33		1938-40	
	Quantity	Proportion of total	Quantity	Proportion of total
High-protein feeds:				
Cottonseed meal and cake	1,821	17.8	2,083	18.5
Linseed meal and cake	309	3.0	258	2.3
Soybean oil meal and cake	114	1.1	1,029	9.1
Peanut oil meal and cake	20	.2	56	.5
Copra meal and cake	102	1.0	146	1.3
Gluten meal and feed	598	5.8	575	5.1
Tankage and meat scraps	399	3.9	377	3.4
Fish meal	120	1.2	251	2.2
Dried skim milk and buttermilk	79	.8	94	.8
Total	3,562	34.8	4,869	43.2
Medium-protein feeds:				
Wheat millfeeds	4,942	48.3	4,682	41.5
Brewers' and distillers' dried grains	250	2.4	260	2.3
Total	5,192	50.7	4,942	43.8
Low-protein feeds:				
Dried beet pulp	224	2.2	290	2.6
Alfalfa meal	314	3.1	416	3.7
Rice bran and polish	90	.9	120	1.1
Oat millfeed ²	175	1.7	125	1.1
Other ³	675	6.6	510	4.5
Total	1,478	14.5	1,461	13.0
Grand total	10,232	100.0	11,272	100.0

¹ The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period July 1, 1937, to June 30, 1940. See footnote, page 5, for reasons for using these periods. The data for the most part are from annual estimates published by the BAE and from the Census of Manufactures.

² Estimated from the oats made into breakfast foods.

³ Includes hominy feed, feeding molasses, screenings, etc. Total quantity was estimated from data supplied by the Census of Manufactures.

The high-protein feeds (table 5) made up about 35 percent of the group of commercial feed materials in the early period and 43 percent in the 1938-40 period. This large increase in high-protein feed materials is chiefly a result of the increase in the production of soybean meal, although there have also been increases in production of cottonseed meal and fish meal.

Cottonseed meal and cake in the years 1929-33 amounted to about 50 percent of the high-protein feed materials. In 1938-40 this percentage was 43, while soybean meal had increased from 3 percent to 21 percent of the total high-protein feed materials. Corn gluten feed is next in importance, followed by linseed meal, fish meal, tankage, and meat scrap.

The medium-protein feeds like bran, middlings, and other by-products of the milling industry (excluding screenings and dry feed) make up around 31 percent of the total group of commercial feed materials in 1929-33 and 44 percent in 1938-40.

The low-protein feeds account for about 15 percent of the total commercial feed materials in 1929-33 and 13 percent in the more recent period. The most important (in tons) of the low-protein commercial feed materials are screenings and dry feed from the milling industry, oat millfeed from the breakfast-food industry, and molasses.

OTHER FEEDS.—In addition to feed grains and commercial feed material other feeds are a part of the total supply of concentrates fed to livestock on farms (table 6). Various seeds and beans, such as cottonseed, velvet beans, and peanuts, are fed whole. The tonnage of this group, which is fed chiefly in the South, appears to have increased substantially.

TABLE 6.—*Quantity of miscellaneous feeds consumed annually by livestock, 1929-33 and 1938-40*¹

Item	1929-33	1938-40
Soybeans fed whole	1,000 tons	1,000 tons
Peanuts hogged-off or fed whole	60	147
Cottonseed fed whole	259	359
Cowpeas fed whole	897	1,048
Cull beans	44	58
Velvet beans fed or grazed	12	14
	587	925
Total	1,859	2,551
Semisolid skim milk or buttermilk (dry equivalent)	14	12
Skim milk or buttermilk fed as such (dry equivalent)	1,623	1,526
Whole milk (dry equivalent)	147	145
Total	1,784	1,683
Potatoes	472	443
Wet beet pulp (dry basis)	176	216
Garbage (dry basis)	661	661
Total	1,309	1,320
Grand total	4,952	5,554

¹ The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period July 1, 1937, to June 30, 1940. See footnote 1, p. 5, for reasons for using these periods.

Another important class of feed is skim milk fed on farms. Although not itself a concentrate as fed, it has been grouped with this class for convenience (on a dry basis). The tonnage does not differ greatly

in the two periods and amounts to about 2 percent of all concentrated feeds. Other semiconcentrate feeds of which substantial quantities are fed and data for which are included here, are potatoes, wet beet pulp, and garbage.

COMPOSITION OF COMMERCIAL MIXED FEEDS

Eleven million tons of commercial feed materials, such as cottonseed meal and bran, were fed annually from 1938 to 1940 out of a total tonnage of grains and other concentrates of 95 million tons (table 3). Not all of the grains or other feeds were fed in their original forms. In 1938-40, of the 78 million tons of grain and 11 million tons of commercial feed materials, probably about 20 million tons or 21 percent, were sold as various kinds of dairy, poultry, and other commercial mixed feeds.

The principal commercial mixed feeds are dairy feeds, poultry scratch feeds, and poultry starters, growers, and mashes and hog feeds. The kinds of feeds that go into dairy mixes are many; the chief ones are listed here: Corn, oats, barley, cottonseed meal, soybean meal, linseed meal, wheat bran, corn gluten, brewers' and distillers' dried grain, screenings, molasses, and alfalfa meal. A list of the principal feeds that go into commercial poultry mashes, starters, and growers would include corn, oats, (barley and wheat in the West) soybean meal, tankage and meat scraps, milk products, fish meal, wheat millfeeds, and alfalfa meal. The commercial scratch feeds are mixtures of corn and wheat, with some grain sorghums, oats, barley, and buckwheat.

HAY, OTHER ROUGHAGE, AND PASTURE

A significant shift to legume roughage has occurred in the last 10 years (table 7). Legume hay, excluding mixed clover and timothy hay, made up 42 percent of all tame hay in 1929-33, whereas in 1938-40 it made up 52 percent of the tame-hay supply. A substantial decrease in mixed clover and timothy hay partly offsets the increase in strictly legume hay so that the net increase in legumes is not so large as the data indicate.

Alfalfa is the chief legume, accounting for 80 percent of legume hay (not including clover)² in the first period and 69 percent in the later period. Although the tonnage of alfalfa increased 13 percent between the two periods, the tonnage of soybean hay more than doubled and the tonnage of lespedeza increased six times, compared with 1929-33. In the more recent period, lespedeza constituted nearly 8 percent of the total legume hay (excluding clover) and soybean hay was nearly 14 percent of the strictly legume hays.

² No estimates are available of the production of clover as it is grouped with timothy in the production statistics, although it is grown alone as well as with timothy.

TABLE 7.—*Quantity of hay and other roughage consumed annually by livestock, 1929-33 and 1938-40¹*

Item	1929-33		1938-40	
	Quantity	Proportion of total	Quantity	Proportion of total
Alfalfa	1,000 tons 23,779	Percent 29.2	1,000 tons 26,991	Percent 31.8
Sweetclover	1,011	1.2	953	1.1
Lespedeza	509	.6	2,997	3.5
Soybean	2,550	3.1	5,406	6.4
Cowpea	1,298	1.6	1,787	2.1
Peanut vine	606	.8	825	1.0
Total	29,753	36.5	38,959	45.9
Clover and timothy ²	30,860	37.9	24,763	29.2
Grains cut green for hay	4,273	5.2	4,220	5.0
Miscellaneous tame hay	5,906	7.2	7,317	8.6
Total tame hay	70,792	86.8	75,259	88.7
Wild hay	10,719	13.2	9,559	11.3
Total all hay	81,511	100.0	84,818	100.0
Sweet sorghum forage	3,123		7,194	
Grain sorghum forage	3,900		4,133	
Corn stover ³	12,833		12,833	
Cottonseed hulls	1,376		1,316	
Straw ⁴	7,746		7,011	
Corn silage	30,823		33,383	
Total all roughage, except pasture	141,312		150,688	

¹ Production of hay adjusted for changes in stocks on farms. The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period July 1, 1937, to June 30, 1940. See footnote 1, p. 5, for reasons for using these periods.

² Clover is grown by itself and with timothy. No estimate is available of the tonnage of clover hay fed.

³ In 1929-33 it was assumed that 20 percent of acreage was usually cut and fed and that stover weighed as much as grain except in the South. The same tonnage was assumed in 1938-40 as in 1929-33, as there was little or no reduction in acreage of corn in States where most of the corn is cut.

⁴ About 68 percent oat straw.

About 6 percent more tame hay was fed per year in 1938-40 than in the earlier period. Substantial increases in corn silage, grain-sorghum forage, and sweet-sorghum forage are also shown. More than twice as much sweet-sorghum forage is reported for 1938-40 as for the earlier period, with most of the increase occurring in the southern Great Plains.

The change in pasture acreage in the two periods is not known because the acreage of pasture is not given in the 1940 census.

FEED CONSUMPTION EXPRESSED IN FEED UNITS

Use of Feed Units as Measure of Nutritive Value

Feeds may be substituted for one another, when they are similar, or even when the composition differs widely. Hay may be substituted for grain in the dairy ration. As all feeds do not have the same nutritive value in a pound, some common denominator is useful so that the approximate total feed nutrients of several kinds of feed combined can be estimated. The total digestible nutrients in a feed is the common denominator usually used. It is a good measure for similar feeds but is not so effective when it is necessary to add together feeds that differ as widely as do grain, hay, corn stover, and tankage. The basis of total digestible nutrients tends to put too high a value on hay

TABLE 8.—*Feeding value of common feed materials compared with corn*

Feed	Composition and net energy per 100 pounds ¹		Relative value when fed to mixed livestock		Relative value when fed to specified livestock as a part of a good ration (protein concentrates fed in limited quantities as a supplement) ⁶									
	Total digestible nutrients	Digestible protein	Net energy ¹	Where protein is abundant and cheap (South and West) ³	Where protein is scarce and used to balance ration (Corn Belt and East) ⁴	Average conditions, United States as a whole ⁴	Dairy cows (grain, silage, and legume hay)	Fattening cattle (grain, silage, and legume hay)	Winter-beef cows	Hogs	Fattening lambs	Horses and mules	Poultry	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Grains:														
Corn (No. 3).....	78.0	7.0	77.7	100	100	100	100	100	100	100	100	100	100	100
Oats.....	71.5	9.4	64.9	91	84	91	88	85	90	90	75	90	85	95
Barley (common).....	78.7	9.3	70.5	100	91	97	94	100	88	100	98	87	90	100
Rye.....	80.1	10.3	72.1	101	93	90	85	90	90	90	90	90	90	90
Wheat.....	88.6	11.3	84.7	106	109	109	105	110	104	107	107	85	85	100
Peterita.....	79.7	10.1	75.2	101	97	95	95	100	100	100	100	100	100	100
Kafir.....	80.1	9.1	75.2	101	97	95	95	100	90	100	91	100	98	100
Milo.....	79.9	8.7	75.2	101	97	95	95	100	90	100	91	100	98	100
High-protein feeds:														
Gluten meal.....	81.8	36.5	80.4	104	103	160	160	160	125	125	125	125	125	125
Gluten feed.....	77.4	22.7	69.4	98	89	125	125	125	275	275	275	275	275	275
Cottonseed meal.....	75.5	35.0	74.2	96	95	165	165	160	160	160	160	160	160	160
Linseed meal.....	78.2	30.6	76.9	99	99	160	160	160	300	300	200	200	150	125
Soybean oil meal.....	82.2	37.7	80.8	104	104	170	170	170	275	275	175	175	150	100
Soybeans.....	86.2	32.8	84.7	109	109	164	164	164	250	250	125	125	150	200
Tannage.....	78.0	56.4	76.7	99	99	250	250	250	250	250	250	250	250	275
Meat scraps.....	71.2	46.7	70.0	90	90	250	250	250	275	275	275	275	275	275
Fish meal.....	67.7	45.4	66.5	86	86	250	250	250	200	200	200	200	200	300
Skim milk, dried.....	84.1	33.1	92.5	106	119	171	171	171	175	175	175	175	175	225
Peanut oil meal.....	82.1	38.0	80.7	104	104	171	171	171	175	175	175	175	175	225
Dried brewers' grains.....	65.3	20.7	58.8	83	76	101	101	101	109	109	109	109	109	109

TABLE 8.—*Feeding value of common feed materials compared with corn—Continued*

Composition and net energy per 100 pounds ¹			Relative value when fed to mixed live-stock			Relative value when fed to specified livestock as a part of a good ration (protein concentrates fed in limited quantities as a supplement) ⁶								
Feed	Total digestible nutrients	Digestible protein	Net energy ¹	Where protein is abundant and cheap (South and West) ³	Where protein is scarce and used to balance ration (North and West) ²	Average conditions, United States as a whole ⁴	Dairy cows (grain, silage, and legume hay)	Fattening cattle (grain, silage, and legume hay)	Wintering beef cows	Hogs	Fatten-lambs	Horses and mules	Poultry	(14)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Medium- or low-protein feeds:														Percent
Wheat bran	70.2	13.1	59.7	89	77	94	90	100						Percent
Wheat middlings	78.4	14.4	70.6	99	91	108	104	110						Percent
Alfalfa meal	53.9	10.8	45.8	68	59	74	70	70						Percent
Hominy feed	85.2	7.8	83.8	108	105	108	108	110						Percent
Oat milled feed	42.6	4.0	39.6	54	51	52	50	50						Percent
Cottonseed, whole	91.0	17.0	89.5	115	113	135	120	120						Percent
Cowpeas	76.5	19.4	75.2	97	97	124	118	118						Percent
Molasses	56.6	9.9	55.6	72	72	72	70	70						Percent
Beet pulp, dried	71.8	4.8	70.5	91	91	91	91	90						Percent
Beet pulp, wet	8.9	3.8	9.2	11	12	12	16	17						Percent
Skin milk	8.6	3.5	9.5	11	12	25	22	22						Percent
Hay and other roughage:														Percent
Alfalfa	49.8	9.6	39.8	63	51	60	50	60						Percent
Red clover	52.4	6.4	41.8	66	54	60	50	55						Percent
Clover and timothy	48.0	4.4	38.4	49	49	51	44	45						Percent
Lespidea	52.2	9.2	43.1	66	55	60	50	50						Percent
Soybeans	50.6	11.1	38.5	64	50	55	50	50						Percent
Cowpeas	49.4	12.6	40.8	63	52	72	50	50						Percent
Peanut vine	57.8	6.3	40.5	73	52	58	40	40						Percent
Timothy	46.9	2.9	35.2	59	45	45	40	40						Percent
Wild hay	36.6	1.6	23.6	46	31	29	40	40						Percent
Prairie hay	47.1	5.6	28.3	60	36	32	40	40						Percent
Millet	51.2	5.2	36.1	65	46	51	50	50						Percent
Sudan grass	48.5	4.3	34.0	61	44	46	45	45						Percent
Oat hay	46.3	4.5	34.7	59	45	48	47	47						Percent
Johnson grass	50.3	2.9	37.7	64	48	46	46	46						Percent
Corn fodder	34.6	3.5	35.5	69	46	46	40	40						Percent
Corn stover	46.2	2.1	23.9	58	31	30	25	25						Percent

Kafir stover	47.7	1.7	25.4	60	33	33	33	33	33	33	33	33
Oat straw	44.1	.9	23.3	56	30	27	30	27	30	27	30	30
Wheat straw	35.7	.8	10.0	45	13	13	13	13	13	13	13	13
Soybean straw	36.5	.9	14.6	46	19	19	19	19	19	19	19	19
Cottonseed hulls	43.7	.1	30.6	55	34	39	34	39	34	39	34	39
Corn silage (cobs)	20.6	1.5	15.8	26	720	720	720	720	720	720	720	720
Corn silage (no ears)	16.3	1.1	12.5	21	16	16	16	16	16	16	16	16
Sorghum silage	17.8	1.1	13.6	23	18	17	17	17	17	17	17	17
Pasture ⁸												

How to use this table: The purpose of this table is to give data for converting different feeds into the feed equivalent of corn. A pound of corn is expressed as 100 percent and a pound of all other feeds as a percentage of corn. Thus in column 7, 100 pounds of gluten meal is equivalent in feeding value to 100 pounds of corn and 100 pounds of alfalfa is equal to 50 pounds of corn. Another way of stating it is that 100 pounds of gluten meal is the equivalent of a pound of corn and 100 pounds of alfalfa is 30 percent of a pound of corn. Some feeds are worth more in a livestock ration under one situation than they are under other situations. Also they may be worth more for one class of livestock than for another. Therefore it is necessary to select one column from those marked 4 to 14 that represents the situation or class of livestock under consideration. If the feeds are fed to several kinds of livestock (as on most general farms) select one of the columns 4 to 7 that most nearly represents the conditions that apply. For instance, if the feeds to be combined are fed on general farms in the Middle West, use the data in column 6. If the study applies to the country as a whole, use the data in column 7. If the feeds are used mainly by a particular class of livestock in an area where protein feeds are usually fed in limited quantities, use one of the columns 8 to 14.

1 The composition and net energy data were taken from MORRISON, F. B., FEEDS AND FEEDING . . . Ed. 20, 1930 pp., Ithaca, N. Y. 1936. Where several grades and classes of a feed were given in the tables in Feeds and Feeding, a grade or class was selected that most nearly represented average conditions. The net energy data for the feeds in column 3 are for fattening cattle, except silage which is for dairy cows. The net energy value for dairy cows would be lower but *relatively* the same.

2 No single measure of the feeding value of different feeds is acceptable under all conditions. Total digestible nutrient is most often used. It is best suited for the comparison of feeds not greatly different in protein content and for comparing feeds to be used for the maintenance of livestock rather than for the production of livestock products or work. In column 4 the feeds are compared with corn as to total digestible nutrients. For instance, 100 pounds of oat straw contains 56 percent as many pounds of total digestible nutrients as does 100 pounds of corn. Or 100 pounds of oat straw is equal to 56 percent as much as 100 pounds of corn where the maintenance of livestock is the main consideration. An example of where this might apply would be the wintering of livestock in the northern Great Plains in a winter when feed was very scarce.

3 In areas where protein needs are abundant and cheap, net energy is a good measure of the feeding value of different feeds. Net energy is the energy available for the production of livestock products, work, and maintenance after the energy used in digestion has been deducted. Much of the energy of some feeds, such as straw, earstalks, etc., is used in digesting them and little remains for productive purposes. When a protein feed is fed in quantities larger than needed to balance the ration it is worth no more than its net energy value. In the South, cottonseed meal and other protein concentrates are commonly fed in greater abundance than needed to balance livestock rations. In the West a similar situation exists because of the abundance of alfalfa hay. In these 2 regions and in other places where a similar situation exists the net energy of a feed is a good measure of its feeding value. In column 5 the feeds are compared with corn (100 percent) according to their net energy value.

4 Where protein feeds are scarce and are used to balance the rations they have a value larger than they would have if the digestible nutrients or net energy were used as the measure. In column 6 the digestible protein in column 2 and the net energy in column 3 for each feed were combined and compared with corn. For most feeds they were combined by giving the protein a weight of 1 and adding the net energy a weight of 1 and adding the 2 results. This weighting was used as it seems to give results in line with experimental data given in columns 8 to 14. Where experimental data showed a different result the figure was brought in line with experimental results. Column 6 is useful for comparing feeds in the North and East, or in other places where proteins are generally scarce.

5 The data for most feeds in column 6 were obtained by combining the digestible protein in column 2 and the net energy in column 3 by weighting the protein 1½ and the net energy 1. These were modified for some feeds in line with experimental results shown in columns 8 to 14. Some allowance was made for losses in feeding value of hay and other roughage due to improper curing, etc.

6 The data in columns 8 to 14 summarize the general relation in feeding value of corn and other feeds as determined by feeding experiments for the specific classes of livestock fed fairly good rations and where protein feeds were fed as a supplement.

7 The data should be considered as general indicators rather than as precise measures. Few experiments have been made in which hay or other roughage is compared with corn or other concentrates. It was assumed from the composition that alfalfa was worth 100 percent as much as corn. Other roughages were compared with alfalfa as 100 percent as shown by experimental data. Sixty percent of these values was then used as the value compared with corn.

⁸ See table 41 for value of pasture expressed in feed units.

and other roughage and too low a value on such protein feeds as tankage and cottonseed meal when fed as supplements to grain.

The "feed unit," which has been used to a limited extent for many years, is a device to convert all kinds of feed to the equivalent of pounds of corn. Although more or less arbitrary, it gives a fairly satisfactory basis for combining feeds that differ widely in nutritive value. The kind of feed unit used will depend on the region or situation involved. Table 8 shows how feed units may be estimated for different situations and for the country as a whole.

Feed Units Used in 1929-33 and 1938-40³

The various feeds making up the total quantity of feed consumed—consisting of grain, commercial feed materials, miscellaneous concentrates, hay, other roughages, and pasture—have been combined for a rough comparison by converting each kind of feed into feed units (table 9). In 1938-40, grain accounted for 32 percent of the total

TABLE 9.—*Average annual feed consumption in the United States, 1929-33 and 1938-40 expressed in feed units¹*

Feed	Feed units per 100 pounds ²	1929-33		1938-40	
		Feed units	Proportion of total	Feed units	Proportion of total
Grains:					
Corn	100	1,000 tons	Percent	1,000 tons	Percent
Oats	88	60,096	24.8	54,219	22.5
Barley	94	14,683	6.0	12,788	5.3
Other grains fed	99	4,733	2.0	3,143	1.3
		6,167	2.5	5,876	2.4
Total grains		85,679	35.3	76,026	31.5
Commercial feed materials:					
Cottonseed meal and cake	140	2,549	1.0	2,916	1.2
Soybean meal	160	182	.1	1,646	.7
Tankage and meat scraps	250	998	.4	943	.4
Other high-protein concentrates ³		1,971	.8	2,373	1.0
Wheat millfeeds	93	4,596	1.9	4,354	1.8
Other medium- and low-protein concentrates ⁴		1,386	.6	1,396	.6
Total commercial feed materials		11,682	4.8	13,628	5.7
Miscellaneous concentrates:					
Cottonseed fed whole	120	1,076	.5	1,257	.5
Other seeds and beans		1,059	.4	1,646	.7
Skim milk fed as such	200	3,568	1.5	3,366	1.4
Other feeds		759	.3	782	.3
Total miscellaneous concentrates		6,462	2.7	7,051	2.9
Total all concentrates		103,823	42.8	96,705	40.1
Hay and other roughage:					
Alfalfa	50	11,890	4.9	13,496	5.6
Other legumes		2,987	1.2	5,984	2.5
Clover and timothy	44	13,578	5.6	10,896	4.5
Other hay		7,450	3.1	7,792	3.2
Total hay		35,905	14.8	38,168	15.8
Corn stover and other dry roughage		7,244	3.0	8,122	3.4
Corn silage	21	6,472	2.6	7,010	2.9
Total hay and other roughage (except pasture)		49,621	20.4	53,300	22.1
Pasture ⁵		89,380	36.8	91,335	37.8
Total of all feed, including pasture		242,824	100.0	241,340	100.0

¹ One feed unit is equal in nutritive value to 1 pound of corn. See page 13 for explanation.

² See table 8.

³ Includes linseed and peanut oil meal, copra and gluten feed and meal.

⁴ Includes brewers' and distillers' grains, alfalfa meal, oat millfeed, molasses, screenings, etc.

⁵ See p. 55 for explanation.

The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period 1,1937, to June 30, 1940. See footnote 1, p. 5, for reasons for using these periods.

³ See footnote 1 page 5 for reasons for using these periods.

feed supply, all concentrates 40 percent, hay and other roughage (excluding pasture) 22 percent, and pasture 38 percent. Compared with the years 1929-33 the significant changes in the period 1938-40 are the decrease in the feed grains and the increase in legume hay, but a considerable shift to hay and pasture is noted and also to a higher percentage of protein in the feed supply. Alfalfa and other legume hays, including clover, probably accounted for 10 to 11 percent of the total feed supply of the country in 1938-40. Commercial feed materials became a more important source of concentrates, and one-half of the commercial feed materials were high-protein feeds compared with one-third in the earlier period.

Pasture is more important in the supply of feed than is generally recognized, although precise data on the feed obtained from pasture for the United States as a whole are not available. However, an estimate made from the number of grazing livestock (tables 38 and 41) showed that pasture accounted for 38 percent of all feed in 1938-40.

LIVESTOCK PRODUCTION 1910-42

CHANGES IN DIFFERENT KINDS OF LIVESTOCK

During the last 30 years, the production of livestock has increased substantially. One-third more pounds of hogs are produced, two-thirds more milk, one-third more eggs, nearly 40 percent more poultry meat, almost twice as many pounds of sheep and lamb, more wool, and a larger poundage of cattle and calves. But if the same point in the beef-cattle cycle were taken, probably little increase in production of beef would be shown. Dairy cattle make up a larger part of the production of cattle and calves and hence of the beef supply than they did 20 to 30 years ago.

The largest production of hogs up to this time occurred in the year 1942. The 21.1 billion pounds produced exceeded the quantity produced in 1923 (table 10). In 1935, after the drought of 1934, production of pork dropped to 10½ billion pounds.

TABLE 10.—*Annual livestock production, excluding horses, mules, and goats, 1910-41¹*

Calendar year	Production on farms (live weight)								Livestock (animal units) not on farms ³
	Milk Million pounds	Cattle and calves Million pounds	Hogs Million pounds	Sheep and lambs Million pounds	Wool Million pounds	Eggs Million eggs	Chickens ² Million pounds	Turkeys Million pounds	
1910	65,090	12,672	12,025	1,150	346	27,000	2,064	—	4,247
1911	65,850	12,596	12,517	1,128	343	29,400	1,965	—	4,261
1912	66,570	13,806	11,945	1,275	319	28,300	1,949	—	4,212
1913	67,710	14,866	12,220	1,187	309	28,100	1,954	—	4,204
1914	69,560	15,562	12,594	1,271	294	27,900	2,018	—	4,092
1915	70,980	15,136	13,935	1,254	281	29,900	1,955	—	4,032
1916	72,300	15,933	13,582	1,118	288	28,800	1,903	—	3,927
1917	73,370	16,764	12,928	1,126	277	27,700	1,934	—	3,753
1918	73,570	15,658	14,792	1,238	296	28,000	2,065	—	3,598
1919	73,800	13,387	13,986	1,143	318	30,500	2,003	—	3,471
1920	75,810	12,403	13,533	926	294	29,700	1,954	—	3,284
1921	78,040	12,817	14,132	1,146	290	30,800	2,111	—	3,023
1922	81,190	13,185	16,518	1,080	270	33,000	2,222	—	2,854
1923	83,840	13,174	17,008	1,253	273	35,000	2,319	—	2,687
1924	89,240	13,402	15,388	1,459	282	34,592	2,300	—	2,550
1925	90,699	12,953	14,168	1,508	300	34,969	2,379	—	2,367
1926	93,325	12,605	14,909	1,609	319	37,248	2,525	—	2,195

See footnotes at end of table.

TABLE 10.—*Annual livestock production, excluding horses, mules, and goats, 1910-41*¹—Continued

Calendar year	Production on farms (live weight)								Livestock (animal units) not on farms ³
	Milk Million pounds	Cattle and calves Million pounds	Hogs Million pounds	Sheep and lambs Million pounds	Wool Million pounds	Eggs Million pounds	Chickens ² Million pounds	Turkeys Million pounds	
1927	95,172	12,072	16,340	1,664	340	38,627	2,636	-----	2,080
1928	95,843	12,327	16,189	1,773	367	38,659	2,432	-----	1,948
1929	98,988	12,754	15,582	1,823	382	37,921	2,596	240	1,747
1930	100,158	13,262	15,176	1,965	414	39,067	2,646	228	1,668
1931	103,029	13,401	16,541	2,050	442	38,582	2,457	244	1,587
1932	103,810	14,191	16,368	1,831	418	36,298	2,556	303	1,497
1933	104,762	15,370	16,566	1,863	438	35,514	2,603	319	1,487
1934	101,624	14,504	12,386	1,921	429	34,429	2,314	300	1,433
1935	101,205	13,650	10,672	1,834	428	33,609	2,437	297	1,336
1936	102,410	14,437	12,975	1,848	419	34,534	2,685	406	1,352
1937	101,908	13,745	12,506	1,938	424	37,564	2,343	376	1,381
1938	105,807	14,046	14,372	2,042	426	37,356	2,531	396	1,326
1939	106,792	15,097	17,081	2,040	428	38,843	2,731	495	1,361
1940	109,510	15,583	17,043	2,087	437	39,585	2,568	510	1,384
1941	115,498	16,530	17,534	2,265	455	41,766	2,576	528	1,384
1942	119,240	17,860	21,091	2,313	459	48,213	2,930	540	-----

¹ Includes estimate of animal units of livestock in cities. For number of horses and other livestock see table 11. The production of livestock is the pounds of cattle, hogs, etc. (live weight) produced each calendar year. The production data given are the official estimates of the Department except for chickens and turkeys, and milk from 1910-1923. Milk production 1910-23 from WPA report, Trends in Size and Production of the Aggregate Farm Enterprise, 1909-36. Where data are missing no estimates were made. The data in this table are as of Apr. 1, 1943, and revisions of these data may be made in later publications of the Department.

² Number produced on farms multiplied by estimated weight. For 1934 to 1940 commercial broilers added to the farm production at 2.9 pounds each: 1934, 34 million head; 1935, 43 million; 1936, 53 million; 1937, 68 million; 1938, 82 million; 1939, 100 million and 1940, 124 million head.

³ Rough estimate by the author—very few data available.

The production of milk in 1942 was the highest recorded in the years covered by this publication, and represented a continuation of the steady upward trend which has persisted over the 30-year period. The production of cattle and calves has varied in wide cycles from 12 billion pounds a year at the low point to around 16 billion pounds at the high point. A high point was reached in 1917; it has not been exceeded until 1942. The low point in the 30-year period was reached in 1927.

Since 1922, production of sheep and wool has shown a steady upward trend. The largest production in the 30-year period occurred in 1942. Production of meat is now much more important in the sheep industry than production of wool. Around 1910, about 30 pounds of wool were produced for every 100 pounds of sheep and lamb, as against 20 pounds in recent years. Production of chickens and eggs has varied only slightly since 1925, with the exception of the drought years. Production of turkeys has been increasing rapidly during recent years and in 1942 they constituted a considerable proportion of the poultry meat produced.

EFFECT OF DECLINE IN NUMBER OF HORSES ON USE OF FEED

The total output of animal products (excluding power from horses and mules) has been around one-fourth greater in recent years than it was around 1910 (table 10). But it is probable that the power output of all horses and mules is not much more than 50 percent of the output 30 years ago. Thus feed that formerly went to horses and mules for the production of power now goes into producing milk, meat, and other livestock products. Farmers now buy gasoline and oil to supply a large part of their power needs.

TABLE 11.—*Animal units (units equal to a milk cow in the consumption of all feed in a year) of each kind of livestock 1910-42¹*

Calendar year	Milk cows	Other cattle	Hogs	Sheep and goats	Poultry	All livestock on farms except horses and mules	Horses and mules	All livestock on farms	Livestock not on farms	All livestock
	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units					
1910-----	19,450	27,680	14,422	6,567	7,038	75,157	23,945	99,102	4,247	103,349
1911-----	19,422	26,462	16,610	6,607	7,523	76,624	24,513	101,137	4,261	105,398
1912-----	19,517	25,311	16,618	6,275	7,252	74,973	24,886	99,859	4,212	104,071
1913-----	19,580	25,908	16,124	5,869	7,203	74,684	25,257	99,941	4,204	104,145
1914-----	19,821	27,748	15,856	5,671	7,238	76,334	25,739	102,073	4,092	106,165
1915-----	20,270	30,505	16,980	5,352	7,479	80,586	26,085	106,671	4,032	110,703
1916-----	20,752	32,680	18,179	5,289	7,294	84,194	26,186	110,380	3,027	114,307
1917-----	21,212	34,837	17,273	5,148	7,104	85,574	26,438	112,012	3,753	115,765
1918-----	21,536	36,053	18,879	5,246	7,178	88,892	26,696	115,588	3,598	119,186
1919-----	21,545	35,384	19,298	5,522	7,710	89,459	26,713	116,172	3,471	119,643
1920-----	21,455	34,262	18,048	5,389	7,515	86,669	26,287	112,906	3,284	116,190
1921-----	21,456	33,081	17,683	5,281	7,325	84,796	25,922	110,718	3,023	113,741
1922-----	21,851	32,861	17,955	4,897	7,816	85,380	25,610	110,990	2,854	113,844
1923-----	22,138	31,786	20,791	4,889	8,218	87,822	25,200	113,022	2,687	115,709
1924-----	22,331	30,566	19,973	4,961	8,612	86,443	24,555	110,998	2,550	113,548
1925-----	22,575	28,559	16,731	5,138	8,634	81,637	23,877	105,514	2,367	107,881
1926-----	22,410	26,716	15,632	5,436	8,710	78,904	23,257	102,161	2,195	104,356
1927-----	22,251	25,149	16,649	5,710	9,166	78,925	22,427	101,352	2,080	103,432
1928-----	22,231	24,564	18,562	6,122	9,443	80,922	21,669	102,591	1,948	104,539
1929-----	22,440	25,506	17,713	6,532	8,952	81,143	20,955	102,098	1,747	103,845
1930-----	23,032	26,580	16,712	6,976	9,355	82,655	18,530	101,185	1,668	102,853
1931-----	23,820	27,447	16,450	7,211	8,949	83,877	17,900	101,777	1,587	103,364
1932-----	24,896	28,612	17,790	7,272	8,751	87,321	17,297	104,618	1,497	106,115
1933-----	25,936	30,995	18,638	7,146	8,967	91,682	16,852	108,534	1,487	110,021
1934-----	26,931	33,132	17,586	7,204	8,724	93,577	16,470	110,047	1,433	111,480
1935-----	26,082	29,935	11,720	6,973	7,827	82,537	16,054	98,591	1,336	99,927
1936-----	25,196	29,856	12,892	6,961	8,060	82,965	15,505	98,470	1,352	99,822
1937-----	24,649	29,014	12,925	7,026	8,488	82,082	15,037	97,119	1,381	98,500
1938-----	24,466	28,548	13,358	7,070	7,808	81,250	14,436	95,686	1,326	97,012
1939-----	24,600	29,000	15,004	7,227	8,332	84,163	14,002	98,165	1,361	99,526
1940-----	24,926	30,290	18,334	7,313	8,803	89,666	13,713	103,379	1,384	104,763
1941-----	25,478	32,188	16,277	7,044	8,586	89,573	13,381	102,954	1,384	104,338
1942-----	26,398	34,135	18,113	7,660	9,602	95,908	13,039	108,947	1,384	110,331
1943-----	26,946	35,856	22,098	7,454	10,760	103,114	12,740	115,854	1,384	117,283

¹ The animal units were computed from the factors given in table 39 and the numbers of livestock on Jan. 1. Animal units may be computed using the factors in table 39 for animal production and would more accurately represent feed utilization than the animal units shown. However, production data for the year are not available until more than a year later than is the number of livestock on Jan. 1. An animal unit in 1910 probably does not quite represent exactly the same quantity of feed as in 1940 because of changes in feed fed per head, especially milk cows and horses and mules.

Horses and mules probably use around 13 million tons less grain and 13 million tons less hay than they used in 1918, the peak year in numbers of horses and mules (table 12). The grain that formerly went to horses is now shared by hogs, milk cows, and poultry. Probably around 2 million more tons of grain and 6 million more tons of hay went to livestock in cities in 1918 than in 1940 (tables 25 and 30). There is, then, a total of 15 million tons of grain and 19 million tons of hay, formerly produced and fed to horses and livestock in cities, that now either goes to other classes of livestock or is not produced. An estimate of this disposal is given in table 13.

TABLE 12.—*Livestock on farms, 1910-42*

Year	Number on hand January 1										Number of turkeys produced during year ⁴	Number of goats clipped during year ⁴		
	Horses and mules					Cattle								
	Milk cows (cows and heifers 2 years old and over kept for milk)	Beef cows (cows and heifers 2 years old and over not kept for milk)	Hogs, including pigs	Sheep and lambs (stock and feeder)	Colts under 2 years old and over	Hens and pullets	All chickens	Turkeys	Hens and pullets	Colts under 2 years				
Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands		
1910	39,543	48,177	19,239	11,334	20,301	4,546	24,847	341,860	381,540	48,215	45,281	517,215		
1911	42,422	55,386	50,555	55,384	47,897	20,659	47,708	25,267	329,070	512,928	55,500	51,928		
1912	46,157	36,158	53,747	53,747	48,652	20,846	4,845	25,691	326,744	367,266	57,000	51,424		
1913	49,580	37,012	43,089	52,863	40,137	21,247	4,931	26,178	328,389	364,670	53,000	53,019		
1914	51,821	39,640	47,579	50,600	45,513	21,562	4,931	26,178	328,389	366,506	53,000	51,495		
1915	52,562	50,000	46,686	60,596	40,010	21,694	4,840	26,534	321,034	369,485	62,000	61,495		
1916	50,752	49,707	57,578	38,896	22,003	4,656	26,650	322,093	359,470	50,500	50,665	508,863		
1917	21,212	51,504	62,931	22,370	4,353	26,723	325,581	365,372	65,100	54,325	543,281	543,281		
1918	21,536	50,549	64,326	41,875	22,576	3,914	26,490	350,662	391,344	65,795	52,029	527,029	527,029	
1919	21,545	50,549	12,525	60,159	40,743	22,386	3,359	25,745	314,474	381,100	51,407	51,407	514,207	514,207
1920	21,455	48,945	12,292	58,942	39,479	22,348	2,789	25,137	331,632	370,125	61,818	55,585	555,585	555,585
1921	21,456	46,944	12,182	59,849	36,922	22,271	2,317	24,588	313,875	394,950	66,201	58,666	584,666	584,666
1922	21,501	46,944	12,182	59,849	36,922	22,271	2,317	24,588	313,875	394,950	66,201	58,666	584,666	584,666
1923	22,138	45,408	11,974	60,304	36,803	22,050	1,968	24,018	311,930	371,100	77,508	61,038	610,188	610,188
1924	22,331	43,665	11,926	57,139	21,576	1,707	23,255	389,626	434,833	21,417	76,809	605,354	605,354	
1925	22,575	40,798	11,204	55,770	38,543	21,038	1,531	22,559	390,517	434,988	21,503	65,508	626,060	626,060
1926	22,410	38,166	10,294	52,105	40,363	20,490	1,495	21,365	393,849	438,939	21,312	62,585	64,454	64,454
1927	22,215	35,927	9,439	55,496	42,415	19,765	1,427	21,192	41,847	480,939	21,191	61,955	693,657	693,657
1928	22,231	35,091	8,926	61,873	45,255	19,120	1,328	20,448	427,139	474,997	21,223	78,889	731,917	731,917
1929	22,440	36,437	8,997	50,042	48,381	18,514	1,230	19,744	403,774	449,007	21,012	69,228	732,325	732,325
1930	23,032	37,971	9,178	55,705	51,565	17,981	1,143	19,124	420,451	468,491	22,218	67,251	714,380	714,380
1931	23,820	38,210	9,817	53,233	50,301	17,375	1,093	18,408	401,776	449,743	23,108	69,191	646,579	646,579
1932	24,896	40,874	10,423	54,822	53,974	16,822	990	17,812	385,826	430,815	24,105	71,362	672,619	672,619
1933	25,936	44,278	11,330	62,127	53,075	16,404	933	17,337	389,743	452,523	24,082	73,186	684,929	684,929
1934	26,931	47,381	12,621	58,621	55,984	1,013	16,997	385,341	433,937	6,309	25,198	68,655	735,322	735,322
1935	26,082	42,764	11,151	59,066	51,808	15,473	1,210	16,633	390,407	389,938	24,187	46,011	597,769	597,769
1936	25,196	42,651	11,048	47,975	14,839	1,387	1,087	16,226	360,687	401,238	5,731	55,730	650,608	650,608
1937	24,649	41,449	10,682	43,083	51,019	14,330	1,472	15,802	376,513	420,237	6,358	53,715	532,580	532,580
1938	24,466	40,783	10,132	44,525	51,210	13,690	1,555	15,245	356,286	386,573	23,215	58,927	583,207	583,207
1939	24,600	41,420	9,987	50,112	51,595	13,273	1,519	14,792	370,751	412,604	6,489	65,561	621,063	621,063
1940	24,926	43,271	10,629	51,012	52,939	13,005	1,476	14,481	384,727	429,042	8,569	63,684	633,275	633,275
1941	25,478	45,983	11,229	54,256	51,808	12,685	1,451	14,136	381,372	422,900	7,623	24,361	635,976	635,976
1942	26,798	48,754	12,124	56,377	55,089	12,270	1,411	13,309	426,226	474,910	7,623	25,159	702,666	702,666
1943	26,946	51,224	12,672	73,660	55,089	12,270	1,410	13,309	426,226	487,089	6,540	25,159	702,666	702,666

¹ Where data are missing no official estimates are available. The data in this table are as of March 1, 1943, and revisions of these data may be made in later publications of the Department.

² This is different from column 1 in that helpers not freshened are not included.

³ Total hogs slaughtered in wholesale and retail establishments and on farms.

⁴ Number sold plus number consumed in households of farm producers plus or minus changes in inventory. Chickens produced excludes commercial broilers.

TABLE 13.—*Changes in utilization of grain and hay, 1918-40*

Item	Grain	Hay
	Million tons	Million tons
Changes in feed fed to:		
Hogs	+3.2	
Milk cows	+3.4	+13.2
Other cattle	-3	+9.5
Sheep	-3	+1.4
Poultry	+3.4	
Total net increase to all livestock except horses and mules and livestock in cities	+9.4	+24.1
Change in total quantity fed to all livestock		
Reduction due to decrease of horses and mules on farms and decrease of livestock in cities	-5.5	+5.2
	14.9	18.9

TABLE 14.—*Animal units of all livestock on farms annually, 1910-42¹*

Calendar year	Animal units equal to a milk cow in feed consumption in a year with respect to—							
	All feed		Concentrates only				Roughage only	
	Concentrates, hay, pasture, etc.		Corn in silage included		Corn in silage excluded		Hay, other dry roughage, silage, and pasture	
	Includ-ing horses and mules	Exclud-ing horses and mules	Includ-ing horses and mules	Exclud-ing horses and mules	Includ-ing horses and mules	Exclud-ing horses and mules	Includ-ing horses and mules	Exclud-ing horses and mules
1910	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units	1,000 animal units
1911	99,102	75,157	134,799	108,092			76,678	59,343
1912	101,137	76,624	142,604	115,304			76,078	55,306
1913	99,859	74,973	141,290	113,608			74,791	56,728
1914	99,941	74,684	140,459	112,390			75,206	56,859
1915	102,073	76,334	141,911	113,304			77,491	58,795
1916	106,671	80,586	149,001	119,984			80,846	61,913
1917	110,380	84,194	154,349	125,179			83,735	64,755
1918	112,012	85,574	153,464	123,929			86,354	67,245
1919	115,588	88,892	160,268	130,316			88,377	69,161
	116,172	89,459	162,951	132,819			88,002	68,878
1920	112,906	86,669	157,199	127,425	183,615	144,719	85,951	67,280
1921	110,718	84,796	154,382	124,772	180,359	141,670	84,117	65,794
1922	110,990	85,380	156,716	127,301	183,086	144,646	83,555	65,554
1923	113,022	87,822	165,684	136,625	193,858	155,881	82,625	64,985
1924	110,998	86,443	163,038	134,646	190,721	153,611	81,043	63,903
1925	105,514	81,637	151,269	123,614	176,717	140,569	78,537	61,902
1926	102,161	78,904	145,915	118,879	170,462	135,255	76,244	60,039
1927	101,352	78,925	148,167	122,188	173,267	139,310	74,302	58,679
1928	102,591	80,922	153,593	128,471	179,745	146,909	73,850	58,766
1929	102,098	81,143	149,678	125,364	174,823	143,041	74,974	60,399
1930	101,185	82,655	147,088	125,102	168,676	142,497	78,016	62,632
1931	101,777	83,877	145,781	124,538	166,860	141,567	79,461	64,601
1932	104,618	87,321	150,489	129,936	172,201	147,729	81,478	67,130
1933	108,534	91,682	156,098	136,062	178,423	154,568	84,635	70,662
1934	110,047	93,577	154,316	134,772	175,860	152,550	87,574	73,900
1935	98,591	82,537	129,750	110,786	146,949	124,366	82,057	68,691
1936	98,470	82,965	132,338	114,106	150,245	128,530	80,781	67,836
1937	97,119	82,082	131,925	114,292	149,961	128,958	79,074	66,499
1938	95,686	81,250	129,862	112,986	147,577	127,474	77,977	65,880
1939	98,165	84,163	136,488	120,124	155,448	135,955	78,628	66,893
1940	103,379	89,666	149,067	133,036	170,320	151,224	80,570	69,079
1941	102,954	89,573	143,763	128,124	163,646	145,017	82,312	71,097
1942	108,947	95,908	154,733	139,454	176,402	158,203	86,041	75,131
1943	115,854	103,114	171,975	157,036	196,767	178,973	88,369	77,714

¹ The animal units were computed from the factors shown in table 39 and the numbers of livestock Jan. 1. Animal units may be computed using the factors in table 39 for animal production and would more accurately represent feed utilization than the animal units shown above. However, production data for the year are not available until more than a year later than is the number of livestock on Jan. 1. An animal unit in 1910 probably does not represent exactly the same quantity of feed as in 1940 because of changes in the quantity fed per head, especially milk cows and horses and mules.

Thus 9 million tons of grain that formerly went to horses now go to other livestock and 5 million fewer tons are produced. All of the hay once fed to horses and mules and 5 million additional tons were used by livestock in 1940.

ANIMAL OR FEED-CONSUMING UNITS OF LIVESTOCK

The total number of livestock or volume of production when measured in animal units⁴ has fluctuated between 97 million and 120 million units over the 30-year period (table 11). The animal or feed-consuming units increased from a low point of 104 million in 1912 to a peak of 120 million in 1919. The drought years 1935-38 were years of low livestock output. In 1943, the number was over 117 million animal units.

The volume of livestock produced, excluding horses on farms and livestock in cities, as measured in animal units, was highest in 1943 (tables 11 and 14). It was 37 percent above 1910, and 15 percent above 1919. Thus the output of livestock for food is at a record level. Among productive livestock (horses not included) the importance of dairy cows and poultry has increased, but production of other cattle, hogs, and sheep has changed little. In 1943, milk cows accounted for 26 percent of the total livestock on farms (excluding horses and mules), whereas cattle other than milk cows accounted for about 35 percent. Hogs accounted for 21 percent, sheep and goats 7 percent, and poultry about 10 percent of total livestock.

UTILIZATION OF FEED

PERCENTAGE USE OF FEED BY LIVESTOCK 1938-40

The importance of each kind of feed varies with different kinds of livestock. Grain makes up a high percentage of the total feed supply for hogs and poultry, and pasture a high percentage of the total for sheep and beef cattle (table 15). In 1938-40, dairy cattle took 34 percent of all feed nutrients, beef cattle 20 percent, hogs 15 percent, and other livestock smaller percentages (table 16). Hogs used about 45 percent of the corn, dairy cattle 17 percent of it, poultry 17 percent, and horses 10 percent. Horses still use more oats than does any other kind of livestock. Poultry and dairy cattle are the large users of commercial concentrates. Dairy cattle took more than half the hay in 1938-40, and horses used less than one-fourth. Dairy cattle also used about 38 percent of the pasture, with beef cattle and sheep together taking about 46 percent.

LONG-TIME CHANGES IN USE OF FEED

The percentage of grain used by different classes of livestock has changed greatly since 1910. Horses and mules took nearly 30 percent before 1920, but in recent years their takings have dropped to half the former figure. Hogs took around 35 to 40 percent of the grain in recent years compared with 30 percent 25 to 30 years ago. The percentage taken by milk cows and poultry has increased also.

Changes in the utilization of corn are also great. Horses and mules probably take around 7 percent of the corn now, compared with 25 percent or more 20 to 30 years ago. Hogs take nearly half of the corn, whereas formerly they took 35 to 40 percent.

⁴See p. 2 for description of animal or feed-consuming unit.

TABLE 15.—*Percentage of total feed units utilized by each class of livestock coming from each kind of feed, 1938-40*¹

Kind of livestock	Concentrates						Roughage			
	Corn ²	Corn ³	Oats	All grain ³	Other	All ³	Silage	Hay	Other dry	Pasture
Milk cows	12.8	7.9	4.9	15.6	8.4	24.0	8.1	24.9	3.1	39.9
All other cattle	11.3	9.5	2.4	12.9	7.2	20.1	3.0	17.1	6.1	53.7
All dairy cattle	12.1	7.5	5.2	14.8	7.4	22.2	7.7	24.5	3.8	41.8
All beef cattle	11.8	11.0	.9	13.0	8.3	21.3	1.4	14.0	6.4	56.9
Beef cows	2.8	2.0	.9	3.6	4.4	8.0	1.3	15.7	7.5	67.5
All sheep and goats	2.1	2.1	1.1	4.1	.3	4.4	.1	10.3	2.1	83.1
All horses and mules	16.7	16.7	13.9	31.4	1.5	32.9	-----	25.7	4.8	36.6
Work horses and mules	17.5	17.5	14.3	32.7	1.6	34.3	-----	25.7	4.9	35.1
All hogs	74.3	74.3	4.2	84.0	10.8	94.8	-----	-----	-----	5.2
All poultry	46.5	46.5	7.4	71.9	23.7	95.6	-----	-----	-----	4.4
Livestock not on farms	21.6	21.6	7.4	41.9	36.1	78.0	-----	22.0	-----	-----
All livestock	24.2	22.4	5.3	31.5	8.6	40.1	2.9	15.8	3.4	37.8

¹ Includes grain and other concentrates fed as such or used in mixed feeds. One feed unit is equal in nutritive value to 1 pound of corn. The data are for the 3-year period from July 1, 1937 to June 30, 1940.

² Includes corn in silage.

³ Excludes corn in silage.

TABLE 16.—*Percentage of total feed units from each kind of feed utilized by different classes of livestock, 1938-40*¹

Kind of livestock	Concentrates						Roughage				All feed
	Corn ²	Corn ³	Oats	All grain ³	Other	All ³	Silage	Hay	Other dry	Pasture	
Milk cows	13.0	8.7	22.9	12.2	23.8	14.7	69.0	38.8	22.7	26.0	24.6
All other cattle	13.7	12.4	13.6	12.1	24.5	14.8	30.8	31.8	53.2	41.6	29.4
All dairy cattle	17.1	11.4	33.3	16.1	29.2	18.9	90.5	53.1	38.3	37.7	34.2
All beef cattle	9.6	9.7	3.2	8.2	19.1	10.6	9.3	17.5	37.6	29.9	19.8
Beef cows	1.0	.7	1.4	.9	4.3	1.7	3.9	8.3	18.6	15.0	8.4
All sheep and goats	.6	.7	1.5	.9	.3	.8	.2	4.8	4.6	16.1	7.3
All horses and mules	9.5	10.2	36.0	13.7	2.4	11.2	-----	22.3	19.5	13.3	13.7
Work horses and mules	9.4	10.1	35.0	13.4	2.4	11.0	-----	21.0	18.8	12.0	12.9
All hogs	45.0	48.4	11.5	39.1	18.4	34.6	-----	-----	-----	2.0	14.7
All poultry	16.7	18.0	12.2	19.8	23.8	20.7	-----	-----	-----	1.0	8.7
Livestock not on farms	1.5	1.6	2.3	2.2	6.8	3.2	-----	2.3	-----	-----	1.6

¹ Includes grain or other concentrates fed as such or used in mixed feeds. One feed unit is equal in nutritive value to 1 pound of corn. The data are for the 3-year period July 1, 1937, to June 30, 1940.

² Includes corn in silage.

³ Excludes corn in silage.

The decrease in the percentage of hay taken by horses and mules has been offset by the increase in the percentage taken by dairy cows. Horses at their peak took nearly 40 percent of the total supply, but now they take only about 20 percent, whereas milk cows recently have been taking nearly 40 percent of the total hay supply. Horses and other livestock in cities probably took 8 million more tons of hay in the early years than they do now.

CHANGES IN EFFICIENCY IN USE OF FEED

The estimated quantities of the principal feeds used by the chief classes of livestock are given in tables 17 to 24. Grain fed per work animal has decreased decidedly during the last 15 to 20 years. Horses probably do not do so much heavy work per head as formerly even though they are fewer in number. Much of the heavy work is done

with tractors. The quantity of feed required to produce a unit of output or a hundred pounds of hogs or cattle, a quart of milk, or a dozen eggs, varies not only between producing areas but also between years. Some of the factors responsible for the year-to-year changes are as follows:

(1) The composition and quality of the rations fed vary with relative prices. During the depression, grain was so cheap in some areas remote from market that farmers could not afford to buy high protein supplements or other materials that would balance the rations, and much more than the usual proportion of the grain was fed without being ground. On the other hand, in the periods of scarcity that followed the droughts, farmers made every effort to make their grain go as far as possible, and rations were carefully balanced and wastage was reduced to a minimum.

(2) The quantities of hay and grain that must be fed to livestock are markedly affected by the severity of the winter, by the length of the pasture season, and by the abundance and quality of the pasturage available during the pasture season.

TABLE 17.—*Horses and mules on farms: Principal kinds of feeds used (except pasture), 1910-41¹*

Calendar year	Corn	Oats	All grain	Other concentrates	Hay	Number horses and mules Jan. 1	Feed used per head annually			
							Feed per head, for all horses and mules and colts Jan. 1		Feed per head, for work animals Jan. 1 ²	
							All grain	Hay	All grain	Hay
1910-----	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 head	1,000 Pounds	Feed per head, for all horses and mules and colts Jan. 1	Feed per head, for work animals Jan. 1 ²	Feed per head, for all horses and mules and colts Jan. 1	Feed per head, for work animals Jan. 1 ²
1910-----	15,941	6,014	21,955	1,273	30,106	24,211	1,814	2,487	2,149	2,720
1911-----	16,277	6,492	22,769	1,535	28,317	24,847	1,833	2,279	2,181	2,472
1912-----	16,756	6,153	23,121	2,058	28,687	25,277	1,829	2,270	2,185	2,464
1913-----	16,316	7,703	24,278	1,986	31,041	25,691	1,890	2,416	2,265	2,648
1914-----	15,099	6,945	22,508	2,268	31,541	26,178	1,720	2,410	2,055	2,639
1915-----	15,782	6,793	23,060	2,296	31,802	26,493	1,741	2,401	2,076	2,625
1916-----	14,957	7,872	23,360	1,562	32,583	26,534	1,761	2,456	2,092	2,687
1917-----	15,316	7,488	23,320	2,324	32,181	26,659	1,750	2,414	2,061	2,624
1918-----	15,018	8,374	23,807	2,279	31,590	26,723	1,782	2,364	2,075	2,548
1919-----	14,414	9,280	24,255	2,273	31,919	26,490	1,831	2,410	2,101	2,582
1920-----	18,018	7,683	26,257	1,562	31,483	25,745	2,040	2,446	2,304	2,600
1921-----	17,716	7,945	26,225	1,547	31,038	25,137	2,087	2,470	2,313	2,600
1922-----	16,276	6,645	23,402	1,800	30,701	24,588	1,904	2,497	2,073	2,609
1923-----	13,424	7,393	21,288	1,943	30,181	24,018	1,773	2,513	1,906	2,611
1924-----	13,747	8,527	22,525	1,158	29,634	23,285	1,935	2,545	2,066	2,634
1925-----	10,635	8,598	19,854	1,551	28,696	22,569	1,759	2,543	1,867	2,625
1926-----	12,047	8,301	20,516	1,135	27,404	21,985	1,866	2,493	1,982	2,571
1927-----	11,288	6,581	18,333	1,516	27,458	21,192	1,730	2,591	1,835	2,676
1928-----	12,480	6,573	19,477	607	26,939	20,448	1,905	2,635	2,018	2,719
1929-----	11,356	7,255	19,097	560	25,117	19,744	1,934	2,544	2,045	2,619
1930-----	9,073	6,762	16,238	666	23,952	19,124	1,698	2,505	1,789	2,574
1931-----	7,056	7,998	15,480	1,007	22,670	18,468	1,676	2,455	1,764	2,520
1932-----	10,257	6,110	17,058	507	21,978	17,812	1,915	2,468	2,012	2,529
1933-----	11,035	4,776	16,134	582	21,426	17,337	1,861	2,472	1,951	2,532
1934-----	8,537	3,029	12,137	1,111	19,676	16,997	1,428	2,315	1,501	2,372
1935-----	6,738	3,583	10,563	1,323	19,597	16,683	1,266	2,349	1,344	2,422
1936-----	5,674	5,620	11,804	912	20,313	16,236	1,454	2,502	1,565	2,595
1937-----	5,422	5,023	10,793	753	19,754	15,802	1,366	2,500	1,478	2,600
1938-----	5,527	5,684	11,553	398	19,464	15,247	1,515	2,553	1,656	2,679
1939-----	5,684	4,996	10,892	563	19,324	14,792	1,473	2,613	1,608	2,747
1940-----	5,180	5,470	10,918	440	19,098	14,911	1,464	2,562	1,646	2,700
1941-----	4,142	6,281	11,023	390	18,107	14,136	1,560	2,562	1,703	2,772

¹ Includes grain and other concentrates fed as such or used in mixed feeds. The tons of feed are for all horses and mules, including colts.

² Horses and mules 2 years old and over. See table 12 for number. All of the colts coming 3 years old may not be worked but are included here for convenience.

TABLE 18.—*Milk cows: Feed fed per 100 pounds of milk produced, 1910-41*¹

Calendar year	Concentrates, including corn in silage			Concentrates, excluding corn in silage ⁴			Silage	Hay	Milk produced
	Corn	All grain ²	All concentrates ³	Corn	All grain ²	All concentrates ³			
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds			
1910	17.0	24.4	33.8	—	—	—	—	60	65,090
1911	17.1	25.1	34.0	—	—	—	—	56	65,850
1912	16.6	24.9	34.8	—	—	—	—	53	66,570
1913	16.0	24.5	32.3	—	—	—	—	59	67,710
1914	15.8	22.9	33.3	—	—	—	—	59	69,560
1915	15.6	22.9	33.2	—	—	—	—	60	70,980
1916	15.6	24.2	31.4	—	—	—	—	63	72,300
1917	15.0	22.0	31.4	—	—	—	—	64	73,370
1918	15.1	23.7	32.5	—	—	—	—	58	73,870
1919	14.6	23.6	32.9	—	—	—	—	60	73,800
1920	14.2	23.6	32.1	8.4	17.8	26.3	50	61	75,810
1921	15.7	25.2	33.5	10.0	19.5	27.8	49	60	78,040
1922	14.7	23.3	32.2	9.3	17.9	26.9	46	64	81,190
1923	14.1	22.7	31.5	8.6	17.3	26.0	47	63	83,840
1924	13.5	22.1	31.8	8.2	16.8	26.5	45	60	89,240
1925	12.0	20.5	30.6	6.8	15.4	25.5	44	60	90,699
1926	13.8	21.9	31.4	9.4	17.5	26.9	41	55	93,325
1927	14.3	22.0	31.0	9.2	16.9	25.9	44	57	95,172
1928	13.7	22.5	31.1	8.7	17.5	26.1	43	65	95,343
1929	14.3	23.4	31.9	9.5	18.6	27.1	41	61	98,988
1930	12.8	22.4	32.0	8.0	17.7	27.3	41	57	100,158
1931	12.1	21.4	31.7	7.2	16.5	26.8	42	52	103,029
1932	14.7	25.2	31.7	9.9	20.4	26.8	42	56	103,810
1933	14.7	23.3	31.3	9.8	18.5	26.4	42	58	104,762
1934	13.2	20.5	30.5	7.8	15.0	25.1	45	53	101,621
1935	11.5	18.7	28.7	5.8	13.1	23.1	47	52	101,205
1936	12.8	21.8	31.5	7.4	16.4	26.1	45	59	102,410
1937	12.7	21.5	31.2	7.2	16.1	25.8	45	59	101,908
1938	14.6	24.0	32.7	8.8	18.2	26.9	45	59	105,807
1939	14.9	24.3	32.9	9.5	18.9	27.5	42	65	106,792
1940	13.6	23.3	33.6	8.4	18.2	28.5	40	63	109,510
1941	12.8	24.0	34.4	7.7	19.0	29.3	40	62	115,498

¹ Includes grain or other concentrates fed as such or used in mixed feeds.² Includes corn, oats, barley, wheat, and other grain fed as such or used in mixed feeds.³ Includes all grain, bran and other byproducts of the milling industry, cottonseed meal, etc., fed as such or used in mixed feeds.⁴ No estimate of silage production available for 1910-19.

TABLE 19.—*Milk cows: Principal feeds used (except pasture), 1910-41* ¹

Calendar year	Corn ²	Corn ³	Oats	Other grain ⁴	All grain ²	Other concentrates ⁵	Silage	Hay ⁶
	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>
1910	5,526	2,067	342	7,935	3,072	-----	19,536	
1911	5,641	2,231	383	8,255	2,933	-----	18,519	
1912	5,511	2,298	479	8,288	3,288	-----	17,791	
1913	5,400	2,576	303	8,279	2,653	-----	20,096	
1914	5,505	2,316	161	7,982	3,599	-----	20,455	
1915	5,552	2,195	373	8,120	3,667	-----	21,155	
1916	5,631	2,689	427	8,747	2,602	-----	22,950	
1917	5,513	2,351	190	8,054	3,463	-----	23,430	
1918	5,582	2,723	459	8,764	3,247	-----	21,540	
1919	5,374	2,582	753	8,709	3,418	-----	22,281	
1920	5,366	3,180	2,747	821	8,934	3,232	18,849	23,044
1921	6,122	3,914	2,847	866	9,835	3,224	19,036	23,569
1922	5,950	3,772	2,770	733	9,453	3,628	18,777	25,823
1923	5,902	3,622	2,786	844	9,532	3,660	19,659	26,511
1924	6,028	3,674	3,051	775	9,854	4,318	20,299	26,624
1925	5,424	3,105	3,221	660	9,305	4,577	19,995	27,042
1926	6,459	4,374	3,181	600	10,240	4,394	20,563	25,522
1927	6,790	4,368	2,975	712	10,477	4,291	20,883	27,255
1928	6,534	4,137	3,090	1,124	10,748	4,092	20,669	30,972
1929	7,086	4,706	3,172	1,304	11,562	4,208	20,516	30,152
1930	6,398	4,019	3,105	1,723	11,226	4,810	20,511	28,606
1931	6,235	3,718	3,028	1,777	11,040	5,296	21,704	26,915
1932	7,645	5,119	3,240	2,214	13,099	3,354	21,783	28,880
1933	7,702	5,144	2,717	1,808	12,227	4,181	22,051	30,284
1934	6,723	3,963	2,789	883	10,395	5,096	23,006	26,799
1935	5,796	2,932	2,726	959	9,481	5,053	23,868	26,288
1936	6,541	3,764	3,500	1,120	11,161	4,972	23,143	30,313
1937	6,467	3,690	3,296	1,208	10,971	4,950	23,145	29,915
1938	7,722	4,671	3,296	1,672	12,690	4,601	23,840	31,309
1939	7,936	5,051	3,468	1,576	12,930	4,611	22,543	34,948
1940	7,426	4,614	3,399	1,949	12,774	5,620	21,974	34,714
1941	7,392	4,451	3,900	2,600	13,892	5,965	22,975	35,840

¹ Includes grain and other concentrates fed as such or used in mixed feeds. See table 18 for feed per 100 pounds milk. No data on silage production for 1910-19.

² Includes the corn in silage. About 11 to 13 percent of the tonnage of silage is corn for grain.

³ Corn fed as such or in mixed feeds excluding the grain equivalent of corn in silage.

⁴ Includes barley, wheat, and other grains fed or used in mixed feeds.

⁵ Includes bran and other millfeeds, cottonseed meal, etc., fed as such or used in mixed feeds.

⁶ All tame and wild hay. Does not include corn stover or straw.

TABLE 20.—*Cattle other than milk cows: Principal feeds used (except pasture), 1910-41*¹

Calendar year	Corn ²	Corn ³	Oats	Other grain ⁴	All grain ²	Other concentrates ⁵	Silage	Hay ⁶
	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>
1910	8,116	—	2,563	473	11,152	2,994	—	21,397
1911	8,819	—	2,600	480	11,899	3,667	—	13,056
1912	8,508	—	2,560	472	11,540	4,440	—	12,875
1913	8,759	—	3,043	368	12,170	3,873	—	15,567
1914	6,128	—	2,539	190	8,857	4,329	—	16,693
1915	7,019	—	2,236	489	9,744	4,515	—	19,326
1916	8,382	—	2,602	331	11,315	3,638	—	25,718
1917	7,728	—	2,525	383	10,636	4,112	—	28,086
1918	9,278	—	2,710	350	12,338	3,980	—	22,076
1919	7,961	—	2,171	552	10,684	3,598	—	21,795
1920	7,734	6,756	2,455	531	10,720	2,488	8,419	24,252
1921	8,506	7,518	2,629	580	11,715	2,438	8,502	23,089
1922	8,005	7,030	2,224	465	10,694	2,882	8,387	27,224
1923	8,524	7,504	2,268	478	11,270	2,817	8,782	27,396
1924	8,413	7,359	2,294	371	11,078	3,010	9,070	26,149
1925	7,077	6,039	2,532	218	9,827	3,476	8,934	23,914
1926	8,312	6,944	2,582	534	11,428	3,643	9,189	20,516
1927	7,599	6,515	2,303	710	10,612	3,938	9,333	21,087
1928	8,422	7,348	2,460	360	11,242	3,200	9,236	26,748
1929	7,770	6,705	2,506	374	10,650	3,215	9,168	26,735
1930	7,530	6,475	2,233	360	10,132	3,444	9,161	24,366
1931	7,089	5,962	2,078	471	9,638	4,420	9,696	19,736
1932	8,040	6,909	2,316	692	11,048	3,437	9,732	19,640
1933	8,690	7,546	2,096	638	11,424	3,281	9,851	22,315
1934	6,232	4,996	1,011	788	8,031	3,559	10,280	20,254
1935	5,997	4,716	1,531	806	8,334	4,195	10,666	17,515
1936	7,671	6,429	2,235	843	10,749	3,512	10,339	23,363
1937	6,035	4,794	1,629	951	8,615	4,188	10,339	21,745
1938	8,519	7,155	2,108	606	11,233	3,961	10,649	23,235
1939	8,319	7,029	2,169	888	11,376	4,603	10,067	29,448
1940	8,533	7,276	2,158	866	11,557	4,186	10,465	31,917
1941	9,014	7,596	2,500	1,200	12,714	4,100	11,075	33,752

¹ Includes grain and other concentrates fed as such or used in mixed feeds. No estimate of silage production for 1910-19.

² Includes the corn in silage. About 11 to 13 percent of the tonnage of silage is corn for grain.

³ Corn fed as such or in mixed feeds, excluding the corn in silage.

⁴ Includes barley, wheat, and other grains fed or used in mixed feeds.

⁵ Includes bran and other millfeeds, cottonseed meal, etc., fed as such or used in mixed feeds.

⁶ All tame and wild hay. Does not include corn stover or straw.

TABLE 21.—*Cattle other than milk cows: Feed fed per 100 pounds of cattle and calves produced (live weight), 1910-41*¹

Calendar year	Concentrates, including the corn in silage			Concentrates, excluding the corn in silage ⁴			Silage	Hay	Cattle and calves produced (live weight)
	Corn	All grain ²	All concentrates ³	Corn	All grain ²	All concentrates ³			
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Million pounds
1910	128	176	223						338 12, 672
1911	140	189	247						207 12, 586
1912	123	167	231						187 13, 806
1913	118	164	216						209 14, 866
1914	79	114	169						215 15, 562
1915	93	129	188						255 15, 136
1916	105	142	188						323 15, 933
1917	92	127	176						335 16, 764
1918	119	158	208						282 15, 658
1919	119	160	213						326 13, 387
1920	125	173	213	109	157	197	136	391	12, 403
1921	133	183	221	117	167	205	133	360	12, 817
1922	121	162	206	107	147	191	127	413	13, 185
1923	129	171	214	114	156	198	133	416	13, 174
1924	126	165	210	110	150	195	135	390	13, 402
1925	109	152	205	93	136	189	138	369	12, 953
1926	132	181	239	110	160	217	146	326	12, 605
1927	126	176	241	108	158	223	155	349	12, 072
1928	137	182	234	119	165	217	150	434	12, 327
1929	122	167	217	105	150	201	144	419	12, 754
1930	114	153	205	98	137	189	138	367	13, 262
1931	106	144	210	89	127	193	145	295	13, 401
1932	113	156	204	97	140	188	137	277	14, 191
1933	113	149	191	98	134	176	128	290	15, 370
1934	86	111	160	69	94	143	142	279	14, 504
1935	88	122	184	69	103	165	156	257	13, 650
1936	106	149	198	89	132	180	143	324	14, 437
1937	88	125	186	70	107	168	150	316	13, 745
1938	121	160	216	102	141	197	152	331	14, 046
1939	110	151	212	93	134	195	133	390	15, 097
1940	110	148	202	93	132	186	134	410	15, 583
1941	109	154	203	92	137	186	134	408	16, 530

¹ Includes grain or other concentrates fed as such or fed in mixed feeds. The production is the live weight of cattle produced annually (not the same as slaughter as production takes account of changes in inventory). This production includes both beef and dairy cattle.

² No data on silage production for 1910-19.

³ Includes corn, oats, barley, wheat, and other grains fed as such or used in mixed feeds.

⁴ Includes all grain, bran, and other millfeeds, cottonseed meal, etc., fed as such or used in mixed feeds.

TABLE 22.—*Hogs: Principal feeds used, 1910-41*¹

Calendar year	Corn	Oats	All grain ²	Other concentrates ³	Production of hogs (live weight)	Feed per 100 pounds of hogs (live weight) produced		
						Corn	All grain	All concentrates
	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>Million pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
1910	22,189	1,285	24,003	2,556	12,025	369	399	442
1911	23,561	1,097	25,455	2,573	12,517	376	407	448
1912	21,279	1,168	23,832	2,837	11,945	356	399	447
1913	23,955	1,213	26,664	2,541	12,220	392	436	478
1914	20,427	1,543	22,962	3,096	12,594	324	365	414
1915	23,441	1,454	26,486	3,210	13,935	336	380	426
1916	25,650	1,692	29,531	2,426	13,582	378	435	471
1917	22,360	1,652	25,334	3,270	12,928	346	392	443
1918	26,361	1,894	30,188	3,243	14,792	356	408	452
1919	24,608	1,495	28,195	2,822	13,986	352	403	444
1920	25,672	1,481	28,827	2,164	13,533	379	426	458
1921	28,993	1,664	32,487	2,067	14,132	410	460	489
1922	31,169	1,777	34,533	2,535	16,518	377	418	449
1923	32,681	1,834	35,683	2,480	17,008	377	420	449
1924	30,105	1,673	32,454	2,029	15,388	391	422	448
1925	25,203	2,006	29,018	2,417	14,168	356	410	444
1926	28,419	1,833	31,430	2,169	14,909	381	422	451
1927	30,156	1,733	33,662	2,481	16,340	369	412	442
1928	28,356	1,791	32,912	2,323	16,189	350	407	435
1929	26,540	1,709	31,484	2,345	15,582	341	404	434
1930	24,672	1,755	29,706	2,557	15,176	325	391	425
1931	24,318	1,816	31,523	2,943	16,541	294	381	417
1932	30,488	1,771	36,328	2,270	16,368	373	444	472
1933	32,055	2,189	37,902	1,985	16,566	387	458	482
1934	22,039	972	23,660	3,135	12,386	356	382	433
1935	16,134	1,005	17,708	3,352	10,672	302	332	395
1936	22,266	1,722	25,788	2,456	12,975	343	398	435
1937	18,389	1,307	20,850	3,261	12,506	294	333	386
1938	25,794	1,820	29,470	2,743	14,372	359	410	448
1939	28,397	1,862	32,816	2,989	17,081	332	384	419
1940	29,739	1,819	33,499	2,187	17,043	349	393	419
1941	30,764	2,200	35,348	2,395	17,534	351	403	430

¹ Includes grain or other concentrates fed as such or in mixed feeds. The production of hogs is the annual live weight produced (not the same as slaughter as production takes account of changes in inventory).

² Includes corn, oats, barley, wheat, and other grains fed as such or used in mixed feeds.

³ Includes tankage, peanuts, etc., as well as the dry equivalent of skim milk fed on farms.

TABLE 23.—*Chickens: Feed fed per 100 eggs produced and per chickens on hand Jan. 1 and production of eggs and number of chickens, Jan. 1 1910-41*¹

Calendar year	Feed per 100 eggs produced		Eggs produced	Feed for all chickens per chicken on hand Jan. 1 ⁴		Number of chickens on Jan. 1
	All grain ²	All concentrates ³		All grain ²	All concentrates ³	
	<i>Pounds</i>	<i>Pounds</i>	<i>Million eggs</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Million head</i>
1910	56	70	27,000	69	82	356
1911	56	73	29,400	67	82	382
1912	56	72	28,300	67	82	367
1913	59	71	28,100	70	81	365
1914	52	68	27,900	65	79	367
1915	50	68	29,900	63	79	379
1916	57	71	28,800	68	81	369
1917	52	69	27,700	65	80	359
1918	54	69	28,000	68	82	363
1919	58	71	30,500	69	81	391
1920	61	68	29,700	71	78	381
1921	59	66	30,800	76	84	370
1922	54	67	33,000	71	84	395
1923	51	63	35,000	68	81	415
1924	52	63	34,592	66	77	435
1925	55	69	34,969	69	83	435
1926	49	61	37,248	68	81	438
1927	48	59	38,627	67	78	461
1928	55	65	38,659	68	79	475
1929	50	61	37,921	68	80	449
1930	47	60	39,067	65	78	468
1931	45	61	38,532	64	79	450
1932	54	66	36,298	71	84	437
1933	53	61	35,514	69	78	445
1934	38	52	34,429	55	68	434
1935	42	58	33,609	65	81	390
1936	47	63	34,534	71	88	401
1937	41	57	37,564	62	79	420
1938	45	60	37,356	74	91	387
1939	43	57	38,843	71	87	412
1940	46	57	39,585	69	83	429
1941	42	55	41,766	74	91	423

¹ Includes grain or other concentrates fed as such or used in mixed feeds.² Includes corn, oats, barley, wheat, and other grains fed as such or used in mixed feeds.³ Includes grains, millfeeds, soybean meal, fish meal, milk products, etc., fed as such or used in mixed feeds.⁴ Includes feed for eggs production and for raising chickens.

TABLE 24.—*Chickens: Principal feeds used, 1910-41*

Calendar year	For all chickens				For egg production		For chicken production	
	Corn	Oats	All grain ²	Other concentrates ³	All grain ²	Other concentrates ³	All grain ²	Other concentrates ³
1910	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
1910	10,117	1,430	12,290	2,300	7,543	1,947	4,747	413
1911	10,347	1,449	12,774	2,874	8,254	2,482	4,520	392
1912	9,921	1,363	12,339	2,692	7,856	2,302	4,483	390
1913	9,972	1,728	12,759	2,058	8,275	1,657	4,484	401
1914	9,225	1,686	11,949	2,622	7,318	2,208	4,631	414
1915	9,349	1,298	12,005	2,985	7,518	2,555	4,487	400
1916	9,306	1,666	12,615	2,382	8,248	1,992	4,367	390
1917	9,020	1,323	11,632	2,758	7,203	2,352	4,429	406
1918	9,043	1,572	12,280	2,522	7,551	2,089	4,729	433
1919	9,931	1,366	13,451	2,329	8,864	1,909	4,587	420
1920	10,147	1,348	13,453	1,482	8,988	1,062	4,465	420
1921	9,979	1,591	13,971	1,490	9,147	1,037	4,824	453
1922	10,017	1,609	13,960	2,630	8,883	2,152	5,077	478
1923	9,923	1,648	14,149	2,748	8,862	2,238	5,287	510
1924	10,349	1,668	14,250	2,476	9,006	1,970	5,244	506
1925	10,470	2,090	15,089	2,990	9,665	2,466	5,424	524
1926	10,635	1,982	14,866	2,800	9,122	2,232	5,744	568
1927	10,537	1,908	15,348	2,683	9,351	2,090	5,997	593
1928	10,802	1,863	16,123	2,589	10,590	2,042	5,533	547
1929	9,858	1,844	15,327	2,733	9,421	2,149	5,906	584
1930	9,625	1,790	15,262	3,072	9,242	2,477	6,020	595
1931	8,779	1,689	14,354	3,463	8,764	2,911	5,590	552
1932	9,862	1,612	15,532	2,922	9,717	2,347	5,815	575
1933	10,019	1,771	15,248	2,053	9,326	1,468	5,922	585
1934	8,957	585	11,884	2,909	6,620	2,388	5,264	521
1935	9,028	780	12,579	3,184	7,035	2,636	5,544	548
1936	9,450	1,694	14,150	3,411	8,042	2,807	6,108	604
1937	8,562	1,479	13,114	3,429	7,784	2,902	5,330	527
1938	8,612	1,616	14,228	3,290	8,470	2,721	5,758	569
1939	9,247	1,616	14,530	3,344	8,272	2,725	6,258	619
1940	9,600	1,508	14,888	2,902	9,046	2,324	5,842	578
1941	10,230	1,934	15,734	3,492	8,770	2,804	6,964	688

¹ Includes grain or other concentrates fed as such or used in mixed feeds. Excludes feed for commercial broilers. The feed per 100 pounds of chicken produced (excluding commercial broilers) was estimated at 500 pounds of concentrates of which 455 pounds were grain.

² Includes corn, oats, barley, wheat, and other grains fed as such or used in mixed feeds.

³ Includes millfeeds, soybean meal, fish meal, milk products, etc., fed as such or used in mixed feeds.

(3) The quantity and kind of feed required per pound of live weight as marketed depends in part on the extent to which the animals are fattened. This varies from year to year depending chiefly on the relative prices of livestock and feed. Light hogs can be produced with less feed per pound than heavy hogs. Some cattle are fattened on pasture with little or no grain. Turkeys sold at 6 months, while still growing rapidly, average only 4 pounds of grain and feed per pound of growth up to that time, but if they are fattened for another month, much more feed is required for each pound of weight added. However, the slower growth of livestock during the fattening period does not mean correspondingly less efficient production because fattening increases the dressing percentage, the percentage of the dressed carcass that is edible, and the calories per pound of edible portion if all of the fat is used for food.

(4) The quantity of feed required depends on the kind of feed and the kind of livestock. Substituting corn for oats, or substituting alfalfa hay for timothy hay ordinarily reduces the pounds of feed but not feed units required per unit of output. The substitution of cows of dairy breeding for cows of dual-purpose or beef breeding ordinarily

decreases the feed required per 100 pounds of milk but may increase the feed per unit of beef production. As a rule, farmers keeping Leghorn hens use less feed per 100 eggs produced and more feed per 100 pounds of chickens marketed than do farmers keeping Rocks. Improved breeding is tending to decrease the quantity of feed required per 100 eggs and per 100 pounds of milk and may have decreased somewhat the quantity of grain required to fatten cattle. These changes are important when present conditions are compared with those prevailing 20 years ago. But as the livestock population of the country increases, pastures in the humid areas are being stocked closer to normal capacity and when weather conditions are unfavorable to pasture growth, more supplementary feed must be provided.

(5) Livestock losses increase feed consumption per unit of output. Losses of pigs and lambs in spring storms, loss of hogs from cholera, loss of calves from Bangs disease, heavy mortality of hens, and decreases in milk and egg production as a result of diseases, all decrease production more than they decrease consumption of feed. Control of diseases is probably a major factor in the long-time trend toward increased efficiency of livestock production.

(6) Some apparent irregularities in feed consumption per unit may result merely from inadequate statistics on such items as (a) weights per head; (b) carry-overs of hay and millfeed; (c) number of cows and chickens kept in towns and villages; (d) quantities of peanuts, velvet beans, soybeans, and other crops harvested by livestock; and (e) variation in the quality of feed produced. There is also considerable variation from year to year in the percentage of calves that are allowed to run with the cows, and the milk they suck is not included in either the milk "produced" or the milk "fed."

Some increase in efficiency (output per unit of feed input) appears to have been made in the use of feed for poultry and perhaps for hogs, during the last 30 years. For livestock that use large quantities of roughage and pasture there is no way of knowing whether any change has occurred, because the quality and quantity of inputs have varied widely and cannot be measured. The few apparent changes that have taken place result more from changes in the number and classes of livestock and poultry and from changes in feeding practices than from physiological changes in a particular class of animal, although progress has been made in the development of higher producing strains.

Evidence indicates that less grain is used now in producing 100 pounds of hogs than was required 15 or 20 years ago, but probably hogs now get more of their feed from legume pasture and less from grain.

Less feed is required to produce 100 eggs now than was needed in 1910 or 1920. This is due partly to an increase in production of eggs per hen which has been brought about chiefly by culling out more of the nonlayers and keeping a larger percentage of pullets in the flocks. A greater proportion of all hens may be of breeds that have high egg-producing characteristics, and high-yielding strains within breeds have been developed.

Production of milk per cow is greater than it was 30 years ago. Many different kinds of feeds, including pasture, are used in the production of milk, but it is impossible to measure their feed value accurately. The "average cow" is made up of all kinds of cows.

Some are high-producing dairy cows; others are beef cows milked for a short time. The probable increase in the proportion of cows of dairy breeding may have influenced the rate of milk production per cow.

Scientists and breeders have developed strains that tend to produce large quantities of eggs, milk, or meat, per head. The adoption of these strains usually results in greater efficiency in the use of feed because the quantities of feed used for maintenance do not differ much between low- and high-producing animals and represent a fixed cost per animal that can be paid for more easily by high-producing animals or birds.

In general, greater efficiency in production of livestock could be achieved if farmers could segregate and consistently remove the low-producing animals in their herds and flocks. Then there is much room for improvement in feeding practices. The vitamin requirements of humans and livestock have just begun to be generally known, and livestock rations have been improved by the widespread adoption of alfalfa, lespedeza, and other legumes. This development has taken place chiefly within the last 20 years, and has been emphasized by the recent conservation programs.

QUANTITATIVE DISTRIBUTION OF FEED TO LIVESTOCK, 1910-41

The estimated quantities of corn, oats, all grain, and hay used by different classes of livestock from 1910-41 are given in tables 25 to 30. The quantity of grain shown includes the grain fed as such and that fed in mixed feeds.

The distribution of hay, silage, and other roughages to the various classes of livestock for 1929-33 and 1938-40 is shown in table 31. Dairy cattle got most of the silage and beef cattle much of the other roughage, which includes corn and sorghum fodder, and straw. The distribution of all concentrates shown in table 3 to the different classes of livestock for the two periods mentioned is given in table 32.

TABLE 25.—*Quantity of all grain (including corn in silage) used by different classes of livestock, 1910-41*¹

Calendar year	Livestock on farms							Live-stock not on farms	Total all live-stock
	Horses and mules	Hogs	Milk cows	Other cattle	Sheep	All poultry	Total		
	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>	<i>1,000 tons</i>
1910	21,955	24,003	7,935	11,152	420	12,749	78,214	4,646	82,860
1911	22,769	25,455	8,255	11,899	412	13,249	82,039	4,690	86,729
1912	23,121	23,832	8,288	11,540	465	12,828	80,074	4,555	84,629
1913	24,278	26,664	8,279	12,170	433	13,263	85,087	4,574	89,661
1914	22,508	22,962	7,982	8,857	464	12,467	75,240	4,371	79,611
1915	23,060	26,486	8,120	9,744	458	12,539	80,407	4,333	84,740
1916	23,360	29,531	8,747	11,315	408	13,163	86,524	4,216	90,740
1917	23,320	25,334	8,054	10,636	411	12,195	79,950	3,979	83,929
1918	23,807	30,188	8,764	12,338	452	12,857	88,406	3,839	92,245
1919	24,255	28,195	8,709	10,684	417	14,043	86,303	3,761	90,064
1920	26,257	28,827	8,934	10,720	338	14,060	89,136	3,515	92,651
1921	26,225	32,487	9,835	11,715	418	14,593	95,273	3,251	98,524
1922	23,402	34,533	9,453	10,694	394	14,596	93,072	3,128	96,200
1923	21,288	35,683	9,532	11,270	457	14,801	98,031	2,960	95,991
1924	22,525	32,454	9,854	11,078	533	14,916	91,360	2,868	94,228
1925	19,854	29,018	9,305	9,827	550	15,770	84,324	2,701	87,025
1926	20,516	31,430	10,240	11,428	587	15,561	89,762	2,521	92,283
1927	18,333	33,662	10,477	10,612	607	16,058	89,749	2,457	92,206
1928	19,477	32,912	10,748	11,242	647	16,847	91,873	2,372	94,245
1929	19,097	31,484	11,562	10,650	665	16,069	89,527	2,128	91,655
1930	16,238	29,706	11,226	10,132	717	15,970	83,989	2,095	86,084
1931	15,480	31,523	11,040	9,638	746	15,088	88,515	1,993	85,508
1932	17,058	36,328	13,099	11,048	666	16,390	94,589	1,866	96,455
1933	16,134	37,902	12,227	11,424	674	16,132	94,493	1,869	96,362
1934	12,137	23,660	10,395	8,031	692	12,764	67,679	1,813	69,492
1935	10,563	17,708	9,481	8,334	694	13,432	60,212	1,648	61,860
1936	11,804	25,788	11,161	10,749	717	15,236	75,455	1,677	77,132
1937	10,793	20,850	10,971	8,615	713	14,127	66,069	1,727	67,796
1938	11,553	29,470	12,690	11,233	767	15,279	80,992	1,614	82,606
1939	10,892	32,816	12,980	11,376	758	15,797	84,619	1,675	86,294
1940	10,918	33,499	12,774	11,557	778	16,174	85,700	1,716	87,416
1941	11,023	35,348	13,892	12,714	817	18,001	91,795	1,840	93,635

¹Includes grain fed as such and used in mixed feeds.

TABLE 26.—Quantity of corn (including corn in silage) used by different classes of livestock 1910-41¹

Calendar year	Livestock on farms							Live- stock not on farms	Total all live- stock
	Horses and mules	Hogs	Milk cows	Other cattle	Sheep	All poultry	Total		
1910	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
1910	15,941	22,189	5,526	8,116	252	10,359	62,383	3,484	65,867
1911	16,277	23,561	5,641	8,819	243	10,597	65,138	3,471	68,609
1912	16,756	21,279	5,511	8,508	274	10,179	62,507	3,325	65,832
1913	16,316	23,955	5,400	8,759	255	10,238	64,923	3,293	68,216
1914	15,099	20,427	5,505	6,128	269	9,498	56,926	3,103	60,029
1915	15,752	23,441	5,552	7,019	266	9,631	61,691	3,033	64,724
1916	14,957	25,650	5,631	8,382	237	9,595	64,452	2,951	67,403
1917	15,316	22,360	5,513	7,728	234	9,317	60,468	2,746	63,214
1918	15,018	26,361	5,582	9,278	258	9,347	65,844	2,611	68,455
1919	14,414	24,608	5,374	7,961	238	10,243	62,838	2,520	65,358
1920	18,018	25,672	5,366	7,734	189	10,467	67,446	2,320	69,766
1921	17,716	28,993	6,122	8,506	234	10,307	71,878	2,113	73,991
1922	16,276	31,169	5,950	8,005	221	10,352	71,973	2,033	74,006
1923	13,424	32,081	5,902	8,524	251	10,267	70,449	1,894	72,343
1924	13,747	30,105	6,028	8,413	293	10,700	69,286	1,807	71,093
1925	10,635	25,203	5,424	7,077	302	10,829	59,470	1,675	61,145
1926	12,047	28,419	6,459	8,312	317	11,001	66,555	1,588	68,093
1927	11,288	30,156	6,790	7,599	328	10,910	67,071	1,474	68,545
1928	12,480	28,356	6,534	8,422	349	11,183	67,324	1,423	68,747
1929	11,356	26,540	7,086	7,770	352	10,248	63,352	1,256	64,608
1930	9,073	24,672	6,398	7,539	380	9,996	58,058	1,215	59,273
1931	7,056	24,318	6,235	7,089	395	9,165	54,258	1,136	55,394
1932	10,257	30,488	7,645	8,040	346	10,314	67,090	1,045	68,135
1933	11,035	32,055	7,702	8,690	350	10,485	70,317	1,047	71,364
1934	8,537	22,039	6,723	6,232	360	9,420	53,311	997	54,308
1935	6,738	16,134	5,796	5,997	354	9,476	44,495	890	45,385
1936	5,674	22,266	6,541	7,671	366	10,024	52,542	889	53,431
1937	5,422	18,389	6,467	6,035	364	9,096	45,773	898	46,671
1938	5,527	25,794	7,722	8,519	383	9,167	57,112	823	57,935
1939	5,684	23,397	7,936	8,319	379	9,918	60,633	838	61,471
1940	5,180	29,739	7,426	8,533	389	10,281	61,548	858	62,406
1941	4,142	30,764	7,392	9,014	397	10,901	62,610	865	63,475

¹ The quantity of corn given here includes the corn fed as grain, corn in silage, corn hogged- or grazed-off. It also includes corn in mixed feeds. "Corn" as given in this table is comparable with "corn production in grain equivalent on the entire acreage" in the official estimates of the Department of Agriculture.

TABLE 27.—Quantity of corn (excluding corn in silage) used by different classes of livestock, 1920-41¹

Calendar year	Livestock on farms							Live- stock not on farms	Total all live- stock
	Horses and mules	Hogs	Milk cows	Other cattle	Sheep	All poultry	Total		
1920	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
1920	18,018	25,672	3,180	6,756	185	10,467	64,278	2,320	66,598
1921	17,716	28,993	3,914	7,518	230	10,307	68,678	2,113	70,791
1922	16,276	31,169	3,772	7,030	217	10,352	68,816	2,033	70,849
1923	13,424	32,081	3,622	7,504	247	10,267	67,145	1,894	69,039
1924	13,747	30,105	3,674	7,359	289	10,700	65,874	1,807	67,681
1925	10,635	25,203	3,105	6,039	298	10,829	56,109	1,675	57,784
1926	12,047	28,419	4,374	6,944	313	11,001	63,098	1,533	64,636
1927	11,288	30,155	4,368	6,515	324	10,910	63,561	1,474	65,035
1928	12,490	28,356	4,137	7,348	345	11,183	63,849	1,423	65,272
1929	11,356	26,540	4,706	6,705	348	10,248	59,903	1,256	61,189
1930	9,073	24,672	4,019	6,475	375	9,996	54,610	1,215	55,825
1931	7,056	24,318	3,718	5,962	390	9,165	50,609	1,136	51,745
1932	10,257	30,488	5,119	6,909	341	10,314	63,428	1,045	64,473
1933	11,035	32,055	5,144	7,546	345	10,485	66,610	1,047	67,657
1934	8,537	22,039	3,963	4,996	355	94,920	49,310	997	50,307
1935	6,738	16,134	2,932	4,716	345	94,976	40,344	890	41,234
1936	5,674	22,266	3,764	6,429	360	100,524	48,517	889	49,406
1937	5,422	18,339	3,690	4,794	357	90,596	41,745	898	42,646
1938	5,327	25,794	4,671	7,155	376	91,867	52,690	823	53,513
1939	5,684	28,397	5,051	7,029	372	99,418	56,451	838	57,289
1940	5,180	29,739	4,614	7,276	382	10,281	57,472	853	58,330
1941	4,142	30,764	4,451	7,598	390	10,901	58,244	865	59,109

¹ Includes corn fed as grain, corn hogged- or grazed-off, and corn used in mixed feeds but does not include the corn in silage. No official estimates are made of corn production excluding corn in silage. The above figures are estimates made by the writer assuming that from 11 to 13 percent of the tonnage of silage produced consisted of the corn in silage. This was deducted from the "all corn" shown in table 26 to arrive at the above estimates for the years 1920-40 for which official estimates of silage production are available.

TABLE 28.—Quantity of oats used by different classes of livestock, 1910-41¹

Calendar year	Livestock on farms							Live- stock not on farms	Total all live- stock
	Horses and mules	Hogs	Milk cows	Other cattle	Sheep	All poultry	Total		
1910	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	929	14,511
1911	6,014	1,285	2,067	2,563	126	1,527	13,552	938	15,031
1912	6,492	1,097	2,231	2,600	124	1,549	14,093	911	14,695
1913	6,153	1,168	2,298	2,560	140	1,465	13,784	915	17,413
1914	7,703	1,213	2,576	3,043	130	1,833	16,498	874	16,150
1915	6,945	1,543	2,316	2,539	139	1,794	15,276	867	15,090
1916	6,793	1,454	2,195	2,236	137	1,408	14,223	796	17,509
1917	7,872	1,692	2,689	2,602	122	1,779	16,756	843	16,374
1918	7,488	1,652	2,351	2,525	123	1,439	15,578	768	18,296
1919	8,374	1,894	2,723	2,710	136	1,691	17,528	763	17,833
1920	9,280	1,495	2,582	2,171	125	1,488	17,141	752	16,642
1921	7,683	1,451	2,747	2,455	101	1,472	15,939	703	17,578
1922	7,945	1,664	2,847	2,629	125	1,718	16,928	650	15,899
1923	6,645	1,777	2,770	2,224	118	1,739	15,273	592	16,790
1924	7,393	1,834	2,786	2,268	137	1,780	16,198	574	18,082
1925	8,527	1,673	3,051	2,294	160	1,803	17,505	540	19,290
1926	8,598	2,006	3,221	2,532	165	2,228	18,750	504	18,700
1927	8,301	1,833	3,181	2,582	176	2,123	18,196	491	18,317
1928	6,581	1,733	2,975	2,303	182	2,052	15,826	474	16,591
1929	6,573	1,791	3,090	2,460	194	2,009	16,117	426	17,262
1930	7,255	1,709	3,172	2,506	200	1,994	16,836	419	16,423
1931	6,762	1,755	3,105	2,233	215	1,934	16,004	399	17,380
1932	7,998	1,816	3,028	2,078	224	1,837	16,981	373	15,793
1933	6,110	1,771	3,240	2,316	200	1,783	15,420	374	14,800
1934	4,776	2,189	2,717	2,096	202	1,946	13,926	363	9,145
1935	3,029	972	2,759	1,011	208	773	8,782	330	10,346
1936	3,583	1,005	2,726	1,531	208	963	10,016	335	15,551
1937	5,620	1,722	3,500	2,235	215	1,924	15,216	345	13,508
1938	5,023	1,307	3,296	1,629	214	1,694	13,163	323	15,300
1939	5,634	1,820	3,296	2,108	230	1,839	14,977	335	14,939
1940	4,996	1,832	3,468	2,169	227	1,882	14,604	375	17,716
1941	5,470	1,819	3,399	2,158	233	1,778	14,837	343	15,200

¹ The quantity of oats given here includes oats in mixed feeds as well as oats fed as grain.

TABLE 29.—Quantity of all grain (excluding corn in silage) used by different classes of livestock, 1920-41¹

Calendar year	Livestock on farms							Live- stock not on farms	Total all live- stock
	Horses and mules	Hogs	Milk cows	Other cattle	Sheep	All poultry	Total		
1920	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
26,257	28,827	6,748	9,742	334	14,060	85,968	3,515	89,453	
1921	26,225	32,487	7,627	10,727	414	14,593	92,073	3,251	95,324
1922	23,402	34,533	7,275	9,719	390	14,596	89,915	3,128	93,043
1923	21,288	35,683	7,252	10,250	453	14,801	89,727	2,960	92,687
1924	22,525	32,454	7,500	10,024	529	14,916	87,948	2,868	90,816
1925	19,854	29,013	6,986	8,789	546	15,770	80,963	2,701	83,664
1926	20,516	31,430	8,155	10,060	583	15,561	86,305	2,521	88,826
1927	18,333	33,662	8,055	9,528	603	16,058	86,239	2,457	88,696
1928	19,477	32,912	8,351	10,168	643	16,847	88,398	2,372	90,770
1929	19,097	31,484	9,182	9,585	661	16,069	86,078	2,128	88,226
1930	16,238	29,706	8,847	9,068	712	15,970	80,541	2,095	82,636
1931	15,450	31,523	8,523	8,511	741	15,088	79,866	1,993	81,859
1932	17,058	36,323	10,573	9,917	661	16,390	90,927	1,866	92,793
1933	16,134	37,902	9,669	10,280	669	16,132	90,786	1,869	92,655
1934	12,137	23,660	7,635	6,795	687	12,764	63,678	1,813	65,491
1935	10,563	17,708	6,617	7,053	688	13,432	56,061	1,648	57,709
1936	11,804	25,788	8,384	9,507	711	15,236	71,430	1,677	73,107
1937	10,793	20,850	8,194	7,374	706	14,127	62,044	1,727	63,771
1938	11,553	29,470	9,639	9,869	760	15,279	76,570	1,614	78,184
1939	10,892	32,816	10,095	10,086	751	15,797	80,437	1,675	82,112
1940	10,918	33,499	9,962	10,300	771	16,174	81,624	1,716	83,340
1941	11,023	35,348	10,951	11,296	810	18,001	87,429	1,840	89,269

¹ Includes corn, oats, barley, rye, wheat, and other grains fed or used in mixed feeds but excludes the grain equivalent of corn in silage. No estimates of silage production are available for 1910-19 so that the grain equivalent of corn in silage was not estimated for 1910-19.

TABLE 30.—Quantity of hay used by different classes of livestock, 1910-41

Calendar year	Livestock on farms					Live- stock not on farms	Total all livestock
	Horses and mules	Milk cows	Other cat- tle	Sheep	Total		
1910	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
30,106	19,536	21,397	3,574	74,613	9,829	84,442	
1911	28,317	18,519	13,056	3,532	63,424	9,775	73,199
1912	28,687	17,791	12,875	3,332	62,685	9,725	72,410
1913	31,041	20,096	15,567	3,137	69,841	9,622	79,463
1914	31,541	20,455	16,693	3,004	71,693	9,428	81,121
1915	31,802	21,155	19,326	2,865	75,148	9,212	84,360
1916	32,583	22,950	25,718	2,817	84,068	8,985	93,053
1917	32,181	23,430	28,086	2,778	86,475	8,572	95,047
1918	31,590	21,540	22,076	2,863	78,069	8,140	86,209
1919	31,919	22,281	21,795	2,949	78,944	7,675	86,619
1920	31,483	23,044	24,252	2,866	81,645	7,250	88,895
1921	31,038	23,569	23,089	2,748	80,444	6,620	87,064
1922	30,701	25,823	27,224	2,619	86,367	6,068	92,435
1923	30,181	26,511	27,396	2,620	86,708	5,535	92,243
1924	29,634	26,624	26,149	2,667	85,074	5,062	90,136
1925	28,696	27,042	23,914	2,776	82,428	4,578	87,006
1926	27,404	25,522	20,516	2,909	76,351	4,075	80,426
1927	27,458	27,255	21,087	3,072	78,872	3,640	82,512
1928	26,939	30,972	26,748	3,279	87,938	3,188	91,126
1929	25,117	30,152	26,735	3,502	85,506	2,750	88,256
1930	23,952	28,606	24,366	3,697	80,621	2,425	83,046
1931	22,670	26,915	19,736	3,796	73,117	2,295	75,412
1932	21,978	28,880	19,640	3,812	74,310	2,255	76,565
1933	21,426	30,284	22,315	3,782	77,807	2,235	80,042
1934	19,676	26,799	20,284	3,783	70,512	2,135	72,647
1935	19,597	26,288	17,515	3,720	67,120	2,050	69,170
1936	20,313	30,313	23,363	3,787	77,776	2,015	79,791
1937	19,754	29,915	21,745	3,904	75,318	1,980	77,298
1938	19,464	31,309	23,235	3,992	78,000	1,945	79,945
1939	19,324	33,821	29,448	4,120	86,713	1,910	88,623
1940	18,379	34,948	31,917	4,021	89,265	1,875	91,140
1941	18,107	35,840	33,752	4,085	91,784	1,845	93,629

TABLE 31.—*Hay and other roughage (except pasture) fed to different classes of livestock, 1929-33 and 1938-40*¹

Item	1929-33			1938-40		
	Hay	Corn silage	Other roughage	Hay	Corn silage	Other roughage
Livestock on farms:						
Milk cows	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
All other cattle	28,192	21,141	6,310	32,941	23,043	7,378
Dairy cattle	23,823	9,627	13,328	26,976	10,278	17,267
Beef cattle	38,776	27,755	10,168	45,053	30,224	12,430
Sheep and goats	13,239	3,013	9,470	14,864	3,067	12,215
Horses and mules	3,574	55	1,401	4,066	62	1,491
Hogs	23,582		7,939	18,910		6,351
Poultry						
Total	79,171	30,823	28,978	82,893	33,383	32,487
Livestock not on farms	2,340			1,925		
Total, all livestock	81,511	30,823	28,978	84,818	33,383	32,487

¹ For the kinds of hay and other roughage see tables 7 and 8. This table is somewhat different from table 30 and other tables showing annual consumption of feed, in that the cattle are classified as "dairy cattle," and "beef cattle" as well as "milk cows" and "all other cattle." These are the total quantities to which the per unit quantities given in tables 37 and 38 relate. The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period July 1, 1937, to June 30, 1940. See footnote 1, p. 5, for reasons for using these periods.

TABLE 32.—*Concentrates fed to different classes of livestock, 1929-33 and 1938-40*¹

Classes of livestock	1929-33				1938-40			
	Corn ²	Corn ³	All grain ³	Other concentrates	Corn ²	Corn ³	All grain ³	Other concentrates
Livestock on farms:								
Milk cows	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons	1,000 tons
All other cattle	6,900	4,400	9,340	4,300	7,600	4,700	9,725	4,861
Dairy cattle	7,820	6,720	9,550	3,600	8,025	6,725	9,450	4,250
Beef cattle	8,870	5,660	12,122	5,100	9,975	6,175	12,860	5,789
Sheep and goats	5,850	5,500	6,768	2,800	5,650	5,250	6,315	3,322
Horses and mules	370	365	693	44	377	370	750	50
Hogs	9,900	9,900	17,081	650	5,550	5,550	11,032	500
Poultry	27,350	27,350	32,933	2,513	26,269	26,269	29,947	2,750
Total	62,521	58,956	86,074	14,113	57,598	53,369	76,314	15,812
Livestock not on farms	1,140	1,140	1,994	1,071	830	850	1,700	1,014
Total all livestock	63,661	60,096	88,068	15,184	58,448	54,219	78,014	16,826

¹ See tables 2, 5, 6, and 8 for more detailed classification of feeds. These are the total quantities to which the per unit quantities given in tables 37 and 38 relate. This table is somewhat different from table 25 and other tables showing the annual quantities of feed fed to different classes of livestock in that cattle are classified as "dairy cattle" and "beef cattle" as well as "milk cows" and "all other cattle." The data are annual averages for the 5-year period July 1, 1928, to June 30, 1933, and for the 3-year period July 1, 1937, to June 30, 1940. See footnote 1, p. 5, for reasons for using these periods.

² Includes the corn in silage.

³ Excludes the corn in silage.

The other feeds that are a part of the total feed supply and the principal kinds of livestock to which each is fed either in mixed feeds or by itself are listed below:

Feed	<i>Principal classes of livestock to which fed</i>
Barley-----	Hogs, dairy cattle
Grain sorghum-----	Hogs, poultry, cattle
Wheat-----	Poultry
Rye-----	Hogs, cattle, poultry
Corn gluten feed-----	Dairy cattle, poultry
Cottonseed meal and cake-----	Dairy cattle, beef cattle
Linseed meal-----	Dairy cattle, beef cattle, poultry
Soybean meal-----	Poultry, dairy cattle, hogs
Peanut meal-----	Dairy cattle, poultry
Copra-----	Dairy cattle, some to poultry (west coast)
Tankage and meat scraps-----	Hogs, poultry
Fish meal-----	Poultry
Milk products-----	Do.
Wheat bran-----	Dairy cattle, poultry
Wheat middlings-----	Poultry, dairy cattle, hogs
Corn feed-----	Dairy cattle and some to poultry
Rye products and rice products-----	Dairy cattle, poultry
Oats, barley, and buckwheat products-----	Dairy cattle and poultry
Brewers' and distillers' dried grain-----	Dairy cattle
Screenings-----	Do.
Beet pulp-----	Dairy cattle, beef cattle, sheep
Molasses-----	Dairy cattle, beef cattle
Alfalfa meal-----	Poultry, dairy cattle, hogs
Soybeans fed whole-----	Hogs, dairy cattle
Peanuts hogged-----	Hogs
Cottonseed fed whole-----	Dairy and beef cattle
Cowpeas fed whole-----	Do.
Velvet beans fed or grazed-----	Do.
Skim milk fed on farms-----	Hogs, calves, poultry
Dried skim milk-----	Poultry, calves in market milk areas

The manufacture of commercial mixed feeds is a large and growing industry, and very few data are available concerning the extent and scope of the industry. Probably over 20 million tons of commercial feeds are mixed in a year by concerns varying in size from large companies of national scope to neighborhood feed mills. No attempt is made in this report to analyze or even outline this important business. But 3 tables (33 to 35) show the feed materials used in 1940 by nearly 400 feed manufacturers in the manufacture of 3 important classes of commercial mixed feeds (poultry scratch feeds; poultry mashes, starters, and growers; and dairy feeds).

These tables show regional differences in the utilization of many feeds, such as the greater use of grain sorghums in the poultry scratch feeds in the areas where grain sorghums are grown. Feeds are substituted for each other, depending on the price; therefore, such tables would vary from year to year or even from month to month. The regional and State data would vary much more than the average for the country as a whole. Commercial poultry scratch feeds are mostly made of corn and wheat, with grain sorghums taking the place of corn in the areas in which they are abundant. Poultry mashes are largely made of corn as a base, with oats, barley and wheat, which are important in some areas, supplemented by the animal proteins, meat scraps and tankage, fish meal, and milk products, and by the plant proteins, soybean meal and linseed meal. Soybean oil meal made up

17.9 percent of poultry mashes, starters, and growers in the eastern part of the Corn Belt. There is a wider variation in the feed-grain base for dairy feeds in different States than for poultry feeds. In the West, barley and wheat take the place of much of the corn and oats. The principal protein supplements are soybean meal, cottonseed meal, and linseed meal, with cottonseed meal more important in the South and copra (before the war) on the Pacific coast.

TABLE 33.—*Poultry scratch feeds: Feed materials used in manufacture in 1940 as reported by feed manufacturers*

Region and State	Corn	Oats	Barley	Grain sorg- hums	Wheat	Rye	Mixed grains	Other grain	Other feed mate- rial
Northeast:	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
New England-----	54.0	2.6	5.2		37.3			0.7	0.2
N. Y.-----	55.9	1.2	6.5	5.8	24.3			4.5	.3
N. J. and Pa.-----	55.4	8.9	4.0	.6	26.5			.2	4.4
North Central:									
Ohio, Ind. and Ill.-----	60.4	.4	5.6	6.2	26.8	0.1	.1	.4	.0
Mich. and Wis.-----	52.3	1.4	5.7		38.3				2.3
Minn. and N. Dak.-----	46.8	1.5	9.2	5.2	33.7				.6
Iowa and Mo.-----	46.3	6.8		21.8	25.1				
S. Dak., Nebr. and Kans.-----	37.1		7.0	26.4	24.8			1.2	3.5
South:									
Del., Md., Va., and W. Va.-----	59.9	.3	1.9	1.4	25.4		3.8	7.3	
N. C., S. C., and Ga.-----	50.4	3.0	1.7		33.0	1.7		1.2	
Ky. and Tenn.-----	79.1			8.7	12.2				
Ala., Miss., Ark., and La.-----	76.4		2.1	7.9	11.5	.3		1.8	
Okl. and Tex.-----	30.4	4.5	5.0	32.9	26.5			.5	.2
West:									
Wash. and Oreg.-----	35.7	7.3	4.7		52.3				
Calif.-----	30.9	.4	8.2	18.7	41.3				.5
8 other western States-----	34.3	.8	2.6	20.6	41.7				
United States-----	53.3	2.0	5.3	8.0	28.7	.2	.4	2.0	.1

TABLE 34.—*Poultry mashes, starters, and growers: Feed materials used in manufacture in 1940 as reported by feed manufacturers*

Region and State	Corn	Oats	Barley	Grain sorghums	Wheat	Rye	Soybeans	Other grains	Cottonseed meal	Linsseed meal	Soybean meal	Peanut meal	Copra	Tankage and meat scraps	Fish meal	Milk products
Northeast:																
New England States	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
N. Y.	36.2	9.0	1.0	—	4.0	—	0	—	—	1.7	0.5	—	—	6.1	5.1	2.5
N. J. and Pa.	30.7	9.1	3.4	—	—	1	—	—	—	—	—	—	—	6.2	2.8	1.7
North Central:																
Ohio, Ind., and Ill.	25.0	2.8	2.1	0.6	1.3	0.2	.8	—	.1	2.6	17.9	1.1	—	8.5	3.9	2.1
Mich. and Wis.	28.7	10.2	.2	.1	3.5	—	2.7	—	—	.4	4.8	0	—	9.4	1.8	3.1
Minn. and N. Dak.	39.1	5.5	.5	—	5.0	—	—	—	—	5.3	11.8	—	—	8.0	2.0	2.7
Iowa and Mo.	24.4	5.5	0	—	.8	0	—	8.1	.2	1.9	13.6	—	—	6.2	2.3	2.2
S. Dak., Nebr., and Kans.	41.3	1.3	.1	1.1	—	—	0	—	—	.2	3.3	—	—	6.2	1.3	.6
South:																
Del., Md., Va., and W. Va.	40.9	7.3	.3	—	.1	—	—	0	.3	10.1	0	—	—	5.3	4.0	1.5
N. C., S. C., Ga., and Fla.	18.1	4.8	—	—	.5	—	.3	—	.2	.8	4.0	4.4	—	7.7	2.4	2.3
Ky. and Tenn.	37.0	2.8	—	—	.9	—	—	—	—	—	15.7	—	—	7.3	—	.1
Ala., Miss., Ark., and La.	42.3	7.3	1.4	—	—	—	—	—	—	1.5	4.7	1.3	—	5.7	2.7	1.5
Oklahoma and Tex.	10.1	13.2	1.1	7.4	3.8	—	0	—	1.1	1.2	2.6	2.0	—	9.2	1.5	2.2
West:																
Wash. and Oreg.	18.4	10.1	5.8	—	14.5	—	—	—	.9	.3	1.7	.4	1.8	12.8	10.3	2.5
Calif.	20.0	4.2	14.1	3.9	6.4	—	.5	—	.1	1.7	4.5	1.5	.8	7.1	9.2	3.0
8 other Western States	18.3	4.5	7.0	2.1	7.4	—	1.8	—	.4	.5	.5	.9	—	5.4	2.4	1.8
United States	28.3	6.6	3.7	1.2	2.5	0	.3	.1	.2	1.1	6.9	.8	.2	7.4	4.2	2.2

Region and State	Wheat bran	Wheat middlings, etc.	Corn gluten feed and meal	Corn feed and hominy meal	Rye and rice products	Oats, barley, and buckwheat products	Brewers' and distillers' dried grains	Screenings	Beet pulp with or without molasses	Molasses or molasses feed	Alfalfa and other hay products
Northeast:	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
New England States	11.8	10.9	2.9	1.5	—	0.8	—	—	—	—	2.1
N. Y.	10.2	16.2	3.7	1.2	—	.4	—	—	—	—	5.2
N. J. and Pa.	11.0	16.1	1.9	1.3	—	3.6	0.3	—	—	—	5.5
North Central:											
Ohio, Ind., and Ill.	7.7	13.9	3.3	.8	—	1.3	—	0.2	—	—	.2
Mich. and Wis.	10.4	14.7	2.6	.2	—	.5	—	—	—	—	2.6
Minn. and N. Dak.	4.7	7.6	.9	—	—	3.3	—	—	—	—	0
Iowa and Mo.	11.0	16.4	1.2	.4	—	1.2	.2	—	—	—	.4
S. Dak., Nebr., and Kans.	1.5	25.5	4.2	5.6	—	3.1	—	—	—	—	4.7
South:											
Del., Md., Va., and W. Va.	5.5	12.2	3.4	1.4	—	.8	—	0	0.4	0	6.5
N. C., S. C., Ga., and Fla.	7.8	25.3	14.0	—	2.3	—	—	—	—	—	.4
Ky. and Tenn.	1.4	29.8	3.6	—	—	—	—	—	—	—	1.4
Ala., Miss., Ark., and La.	7.9	13.6	3.7	.7	1.3	1.7	—	—	—	—	2.7
Oklahoma and Tex.	9.6	20.1	3.2	5.5	.8	.2	—	—	—	—	0
West:											
Wash. and Oreg.	6.4	11.3	—	—	—	—	—	—	—	—	1.1
Calif.	11.8	2.1	—	.1	1.5	0	—	—	.1	.1	1.0
8 other Western States	33.1	5.9	4.4	—	—	—	—	—	.2	.5	.1
United States	9.1	13.8	3.1	1.4	.4	1.0	0	0	.1	.5	4.9

TABLE 35.—*Dairy feeds: Feed materials used in manufacture in 1940 as reported by feed manufacturers*

Region and State		Corn		Oats		Barley		Grain sorghums			Wheat		Rye		Soybeans			Mixed grains			Cottonseed meal		Linseed meal		Soybean meal		Peanut meal		Copa		Tannage—meat scraps ¹		Fish meal		Milk products ¹	
Northeast:		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.					
New England States		15.6	5.9	0.7	—	—	—	—	—	—	—	—	—	—	—	—	—	5.4	7.4	4.3	0.3	—	—	—	—	—	—	—	—	—	0.1	—				
N. Y.		3.4	1.0	.8	—	—	—	—	—	—	—	—	—	—	—	—	—	3.3	7.3	14.9	.2	0.7	—	—	—	—	—	—	—	—	—	—				
N. J. and Pa.		10.4	7.0	2.0	—	0.4	—	—	0.6	—	—	—	2.9	11.6	10.8	—	.6	2.5	0.4	—	.2	—	—	—	—	—	—	—	—	20.2	—					
North Central:		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Ohio, Ind. and Ill.		7.0	3.7	1.7	—	—	—	0.7	1.9	—	—	7.9	3.6	23.5	2.3	—	—	1.6	.2	—	—	—	—	—	—	—	—	—	—	—	—					
Mich. and Wis.		4.6	4.0	4.2	—	—	—	.1	—	—	—	.4	3.7	11.7	1.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Minn and N. Dak.		8.2	11.7	6.8	—	—	—	—	—	—	—	4.2	8.8	5.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Iowa and Mo.		8.8	3.8	—	—	—	—	—	—	—	—	5.8	7.2	6.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	110.0	4.7				
S. Dak., Nebr., and Kans.		4.3	3.0	3.0	0.7	.4	—	—	—	0.1	—	2.1	1.9	3.4	—	.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.4	—				
South:		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Del., Md., Va. and W. Va.		5.3	4.5	.3	—	—	—	.1	—	—	—	5.5	3.6	14.3	2.6	—	—	.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
N. C., S. C., Ga., and Fla.		16.6	7.6	—	—	—	—	.1	—	—	—	11.1	1.7	3.2	9.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Ky. and Tenn.		7.2	1.4	—	—	—	—	.1	—	—	—	8.2	.9	23.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.3	—				
Ala., Miss., Ark., and La.		4.5	1.6	—	—	—	—	—	—	—	—	16.7	6.1	10.2	4.4	.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Okla. and Tex.		5.1	4.3	.7	1.2	.9	—	—	—	—	—	11.5	2.5	3.1	.9	—	—	.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
West:		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Wash. and Oreg.		6.9	10.3	7.9	—	—	—	7.3	.2	—	—	5.0	4.9	5.7	3.0	11.3	—	.6	.3	—	—	—	—	—	—	—	—	—	—	—	—					
Calif.		2.8	2.5	16.3	.8	1.0	—	—	—	—	—	6.3	6.2	2.1	1.4	14.4	—	.1	.1	.1	—	—	—	—	—	—	—	—	—	—	—					
8 other western States		4.0	6.2	29.5	.5	19.9	1.7	1.4	—	—	—	2.0	.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
United States		6.8	4.0	3.5	.2	.6	.1	.3	—	—	—	6.2	6.1	9.9	1.4	2.8	—	.3	.1	.1	—	—	—	—	—	—	—	—	—	—	—					

Region and State		Wheat bran		Wheat middlings		Corn gluten feed and meal		Corn feed and hominy meal		Rye and rice products		Oats, barley, and buckwheat products		Brewers' and distillers' dried grain		Screenings		Beet pulp with or without molasses		Molasses or molasses feed		Alfalfa meal												
Northeast:		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.												
New England States		15.2	7.4	10.9	6.7	0.3	—	—	—	3.9	6.1	0.5	2.8	6.3	0.2	—	—	—	—	—	—	—	—											
N. Y.		7.6	4.3	15.2	3.9	—	—	—	—	2.3	12.4	7.9	2.6	12.1	.1	—	—	—	—	—	—	—	—											
N. J. and Pa.		10.9	5.6	11.4	3.8	—	—	—	.5	9.7	1.6	.3	6.1	.5	—	—	—	—	—	—	—	—	—											
North Central:		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—					
Ohio, Ind. and Ill.		6.8	6.4	3.5	1.3	—	—	—	.7	4.4	9.1	.2	10.0	3.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
Mich. and Wis.		9.5	2.9	2.8	.1	—	—	—	.3	7.4	36.4	.2	7.2	2.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Minn. and N. Dak.		9.9	9.0	10.5	—	—	—	—	—	—	—	22.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
Iowa and Mo.		8.3	1.5	16.7	—	—	—	—	—	7.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17.5	1.7		
S. Dak., Nebr., and Kans.		7.5	2.2	12.1	1.5	—	—	—	2.4	.1	8.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8.1	38.1			
South:		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Del., Md., Va., and W. Va.		9.8	5.1	7.9	5.8	—	—	—	2.3	11.5	11.6	1.5	7.9	.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.3			
N. C., S. C., Ga., and Fla.		9.5	3.7	6.9	.4	4.2	—	—	2.2	—	5.7	2.5	.8	8.8	6.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Ky. and Tenn.		4.5	7.0	1.7	1.4	—	—	—	—	—	6.7	.5	—	18.5	17.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
Ala., Miss., Ark., and La.		11.0	.8	2.9	1.6	10.5	—	—	3.2	1.9	2.1	.9	.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	17.8	3.4			
Okla. and Tex.		7.5	5.9	5.0	6.7	.7	—	—	.1	—	9.1	2.9	2.0	20.7	10.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
West:		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Wash. and Oreg.		15.9	17.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.4	
Calif.		5.6	.4	.6	.2	2.4	—	—	.1	.3	1.6	4.5	2.1	—	28.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
8 other western States		4.2	2.0	1.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6.9		
United States		9.0	4.8	7.8	3.1	1.2	—	—	1.4	—	5.9	5.9	1.9	9.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		

¹ Tannage, fish meal, and dried skim milk and buttermilk appear to have been used chiefly as feed for calves.

THE PROTEIN SITUATION

Protein is the body-building material. Protein is about 10 percent of the dressed weight of hogs, 12 percent of lamb, and 15 percent or more of beef and poultry. Fresh milk contains about 3½ percent protein and dried skim milk about 35 percent. Protein is required for the growth of new tissue in the young animal and for the renewal of tissues in the mature animal. Growing animals need more protein than mature animals. A class of livestock such as horses, that consists mostly

of mature animals, needs much less protein than other classes of livestock where the proportion of young growing animals is greater. Dairy cattle and poultry require large quantities of protein because milk and eggs contain much protein.

Our livestock are not fed enough protein for greatest efficiency. Probably not more than 85 percent of the protein concentrates that would be desirable is fed, although more per animal unit is fed now than was fed 10 or 15 years ago. Much more alfalfa and other legumes are fed than was true a few years ago, but many farms still do not have a legume hay for cattle.

This protein deficiency is not so bad in some areas. The South has an adequate supply of protein concentrates, although it is generally short of good hay and of grain. Many livestock in the South get more cottonseed meal than they need from a protein standpoint. In the West (excluding the Great Plains) protein is generally supplied in adequate quantities as alfalfa hay is abundant and cheap.

The principal deficit areas for protein feeds are the Corn Belt and the Great Plains. Although alfalfa and clover are generally grown in the Corn Belt, many farms are without legume roughage. The situation is even worse in the Great Plains, where sorghum and corn fodder, wild hay, and straw supply most of the roughage. Little protein feed is used in the Plains chiefly because feed grains are usually low in price compared with protein concentrates. It is difficult to grow legumes under dry-land conditions.

The protein situation differs between classes of livestock. Dairy cows in the East and Northeast are generally fairly well supplied with proteins. Most of the feed either is bought as a commercial mixed feed or is home-mixed. Most dairymen realize the necessity of using protein supplements if they mix their own feed, and they can see the guarantee as to composition of the commercial feeds. The importance of legume hay is generally recognized.

In the dairy States of the Middle West the importance of legume hay is recognized and the acreage of alfalfa has increased greatly in the last 10 or 15 years. Most commercial dairymen have alfalfa; and this, together with home-grown feeds, makes a good ration for the ordinary herd.

Many small herds in the dairy areas of the Middle West, however, are not adequately supplied with protein. Not enough clover or alfalfa is grown, and the home-grown grains are not supplemented with protein concentrates. This condition is even more pronounced in the Corn Belt on farms where dairying is not the main enterprise and where an abundance of feed grains is available. Commercial poultry flocks whether large or small, are generally fed a fairly adequate supply of protein feeds, because poultrymen of this class use commercial mixed mashes and starters and understand the need for considering the protein content of the feed. Ordinary farm flocks are more commonly deficient in protein. These flocks, particularly in the Corn Belt, are fed on farm grains and the feed they can salvage around the farm.

Hogs are more deficient in protein feed than any other class of livestock. Many farmers still think that they can be raised on corn alone. The fact is that they are fast-growing animals and need a lot of protein especially up to 100 pounds in weight. Clover or alfalfa pasture and skim milk are the principal protein sources for Corn Belt hogs, but these are not always available in adequate quantities.

It takes the skim milk from about 7 cows to provide 30 hogs with a full supply of protein. Tankage is the most common supplement purchased; but not nearly enough of it is fed, as it usually costs more than twice as much per pound as corn. Soybean meal may be used to mix with the tankage for pigs; it may also be used as the only supplement after the pigs reach a weight of 100 pounds. Not enough tankage or other animal protein is available to balance commercial poultry feeds and in addition to furnish the animal protein that should be fed to hogs. The available supply of tankage should be made to go as far as possible by mixing it with some plant protein such as soybean meal. This mixture is cheaper than tankage and serves the same purpose about as effectively as tankage alone. Probably every ton of this mixture fed to hogs would replace enough corn to produce 800 pounds of hogs. It is important that feed be made to go as far as possible in producing livestock during the war.

The Corn Belt is the principal feed-producing area of this country, but it is also an area in which livestock are greatly in need of additional protein feeds. Soybean meal and legume hays and pasture are a solution to this problem; both are readily available in most of the region. This is the center of the soybean industry. With liming of the soil, alfalfa and clover can be grown anywhere in the region, and in many areas without liming. Soybean hay and lespedeza are other legumes that are grown to supply protein needs.

EFFICIENCY OF LIVESTOCK IN CONVERTING FEED INTO HUMAN FOOD

Livestock, with the exception of horses, convert feed crops into human food. Many kinds of feed materials are converted into food. Some of these, such as the feed grains, can be used directly as human food, but about two-thirds of the feed used by livestock is not fit for human consumption. In this category are hay, pasture, millfeeds, and other feeds that are converted into meat, eggs, and milk. Much of the protein needed in the human diet is supplied by livestock products, and these products also supply some of the energy foods.

The various kinds of livestock differ in their ability to convert feed materials into human food. To measure this difference, the feed units used to produce the live animal were calculated per pound of dressed product as bought by the consumer (table 36). Feed was shown in three ways: (1) All feed including pasture, (2) all feed excluding pasture, and (3) grain and concentrates only. The second category was shown because this represents harvested feeds upon which much labor is applied. It will be seen that there is not a great deal of difference in the feed (excluding pasture) used per dressed pound for the different kinds of meats or for a pound of eggs. These are averages for the United States and, in the case of beef cattle and sheep especially, they represent an average of all kinds of production from range cattle and sheep on grass to Corn Belt feed lots. The feed used by milk cows only, not including young stock, was calculated per pound of milk. When all the feed nutrients are considered, including those produced from grass, sheep and beef cattle take much more per pound of dressed meat than do hogs or poultry. Sheep, however, produce wool and meat from the same feed.

The food values of a pound of the various livestock products are not the same. The values per pound of dressed (ready to cook) product have been expressed in four ways: (1) Number of calories or energy value, (2) pounds of protein, (3) a combination of calories and protein called "caloric protein index",⁵ and (4) selling price per pound (dressed-weight basis) at the farm. If the energy value of food is used as a measure, pork is the highest, and a pound of dressed beef, or lamb, or turkey is lower, and these three do not greatly differ from each other. Chickens and eggs are lower and milk has the lowest number of calories per pound because of its high percentage of water. If protein is used as the measure of food value per pound of dressed product, ready to cook, it is found that turkey, chicken, and beef are the highest, followed by lamb, eggs, pork, and milk. If the energy-plus-protein index is used as a measure of food value, there is not much difference between pork, turkey, chicken, beef, or lamb. The price received by farmers (per pound of dressed product, ready to cook) in 1940 was highest for turkey and chickens, followed by beef cattle, lamb, eggs, pork, and milk. Considering the food value, turkey and chicken meat⁶ were high priced compared with other livestock products, especially pork and milk.

Efficiency in converting feed materials into human food may be expressed by the feed units used to produce a given quantity of energy, protein (or a combination of the two), and money value. The average person (including children) probably should use about 2,600 calories of energy a day and should have about 67 grams (0.15 pound) of protein a day; therefore, the number of feed units used by each class of livestock to produce 2,600 calories and 0.15 pound of protein was calculated.⁷ When all feed, including pasture, is used in calculating feed units, and calories of energy are used as the measure of food value, hogs and milk cows are found to be by far the most efficient converters of feed into human food. They are followed by turkeys, laying flocks (eggs), chickens for meat, beef cattle, and sheep, in the order named. When the feed units from pasture are omitted, dairy cows (whole milk used for food) and hogs are still the most efficient converters of feed into energy.

The livestock that are most efficient in converting feeds into human food, when protein is used as the measure of food and all feed including pasture is used as the measure of feed, are milk cows (whole milk used for food), and turkeys, with chickens for meat and eggs following in the order named. If pasture is omitted, milk cows are first by far.

⁵ See footnote 4, table 36.

⁶ Turkey and chicken meat were computed on a "ready to cook" basis after feathers, blood, head, feet, and entrails were removed.

⁷ This assumption that 0.15 pound of animal protein and 2,600 calories of energy are about equal in food value and importance seems reasonably consistent with the usual difference in the prices of principal foods of animal origin, insofar as these prices reflect differences in basic food nutrients rather than flavor, palatability, and incidental values due to contained vitamins and minerals. Thus taking the estimated average composition of selected foods and "medium fat" meats, as published in U. S. Dept. Agr. Circular 549, Proximate Composition of American Food Materials, and valuing the various foods at \$1 per pound of protein and 7 cents per 1,000 calories the computed food values would compare as follows: American cheese, 36 cents per pound; cottage cheese, 22 cents per pound; eggs, 22 cents per dozen; milk, 12.2 cents per quart; evaporated milk, 10.4 cents per 14½-ounce can; round steak, 23 cents per pound; leg of lamb, 21 cents per pound; smoked ham, 25 cents per pound; dressed chicken (not drawn) 16 cents per pound; haddock fillet, edible portion, 20 cents per pound. However, no scale based on protein and calories alone will reflect market values due to other factors. For example, at 7 cents per 1,000 calories butter would be worth only 24 cents per pound whereas lard, which can be more cheaply produced and which usually sells for about a third of the price of butter would be worth 28 cents per pound. For vegetable products, this scale would be less satisfactory because of wider differences in costs of production, cost of preparation for food, digestability, vitamin content, etc. Thus at the above values per unit, beans (now selling at about 10 cents) would be worth 32 cents per pound, and corn meal 19 cents, whereas the food value of strawberries would be only 3 cents per quart or much less than the cost of production.

TABLE 36.—*Approximate relative efficiency of different classes of livestock in converting feed into human food, average, United States*

This table is designed to give some idea of the average efficiency of different kinds of livestock in converting feed into human food. Data vary considerably from the U. S. average for regions or smaller areas and for segments of the industry such as "cattle feeding," "broiler production," etc. Four measures of the value of food are given: (1) Calorie or energy value; (2) protein content; (3) combination of energy and protein; (4) selling price. Other important considerations in valuing foods are the vitamin and mineral content. In this table the dressed product to which the data apply is an average of all classes and grades of animal in each general class and to all of the carcass that is edible and not to any particular cut or part of the carcass. The comparison of the human food from milk cows with other livestock assumes that the whole milk was used as human food. The comparison would be less favorable for milk cows, if the skim milk was fed to livestock and only butter used for human food. About one-half of the milk produced is used as whole milk for human food.

1 Dressed weight means the weight of product as ordinarily bought ready to cook or use for food. In the case of hogs 53.4 pounds of fresh pork plus 15 pounds of rendered lard and 2.5 pounds of edible offal are sold at retail from 100 pounds live weight of hogs. In the case of chickens, 13 percent of the live weight is lost in blood and feathers and 16 percent of the live weight is lost in heart, feet, and inedible entrails. Eggs in the shell are considered here as "dressed product." A yield of 43.2 pounds meat, 3.0 pounds edible offal, and 2.7 pounds of edible fat (ready to eat) was assumed for beef cattle. For sheep, 44.2 pounds meat, 2.5 pounds edible offal, and 1.7 pounds edible fat were used.

2 Includes feed for milk cows only and not for other dairy cattle or for raising replacements. Twenty pounds of wool are produced for each 100 pounds lamb and mutton live weight.

³ Compiled or taken from data given by CHATFIELD, C., and ADAMS, G. PROXIMATE COMPOSITION OF AMERICAN FOOD MATERIALS. U. S. Dept. of Agr. Cir. 549, 91 pp. 1910. The beef and veal produced as a byproduct of the dairy industry (7.1 pounds per 100 pounds of milk) is not included as food in the column headed "milk cows." Milk only is included.

⁴ The food requirement of an average person (including children) in a day should contain about 2,600 calories of energy and 67 grams (0.15 pound) protein (1859 Y earbook of Agriculture, p. 320). In order to combine the calorie and protein content of food into one measure it was assumed that 2,600 calories of energy are equal in importance in our food supply to 0.15 pound of protein, and each quantity was given a weight of one-half in the index. Then a food may be evaluated by the number of calories it contains in relation to 2,600 and the pounds of protein it contains in relation to 0.15 pound and the sum of the two will give an index of the food based on the calorie and protein content. Thus 1 pound of beef contains 1,020 calories on 0.39 of 2,600. It also contains 0.147 pound protein or 0.98 of 0.15 pound. One-half of 0.39 plus one-half of 0.98 gives an index of 0.68. A similar computation for 1 pound of pork gives 0.71, for milk 0.17, for eggs 0.50, for turkeys 0.65, and for turkeys 0.72. Thus, when the number of calories and the protein contents are both taken into consideration, a pound of pork, beef, lamb, and poultry meat are not greatly different in food value. Although a pound of turkey has over twice as much protein as a pound of pork (including lard), it has less than half as many calories. In a mixed diet a pound of dressed hog and a pound of turkey may make about equal contributions although greatly different in composition.

⁵ Value per pound for all livestock except beef cattle computed by dividing gross income by production (B.A.E.). The beef cattle price is the average price received by farmers.

When the combination of energy and protein is used as the measure of food, and all feed including pasture is used as the measure of feed input, it is found that, followed by hogs and turkeys, milk cows (whole milk used for food), are the most efficient converters of feed into food. If pasture is omitted, dairy cows are the most efficient, with other classes taking from two to three times as much feed for a given quantity of food.

About 12 to 15 pounds of grain must be fed to livestock to produce enough meat and other livestock products to support a man for 1 day, whereas 2 or 3 pounds of grain (corn, wheat, rice, soybeans, etc.) eaten directly will support a man for a day. Thus, a given quantity of grain will support several times the number of people if eaten directly, than when fed to livestock and the meat from the livestock eaten. This may account for the scarcity of livestock in some heavily populated countries.

From a physical standpoint, livestock do not convert grain into human food efficiently but they do convert into food grass and other roughage that is unfit for humans. Much of this roughage is produced on land that either should not be cultivated or should be used as part of a cropping system to prevent erosion and to maintain the productivity of the soil. More than half the total feed supply of the United States is roughage and is fit only for livestock. The range lands of the West produce a large quantity of livestock but would have little value in the direct production of human food.

Livestock also furnish animal proteins in the human diet. Animal proteins appear to be superior to plant proteins in the diet of both humans and some kinds of livestock. They are at least a necessary supplement to plant protein.

Meat, milk, and eggs also supply a number of vitamins that are necessary for full efficiency of the human race. They give a variety to the diet and thus contribute to a high level of living.

Through meat and milk, livestock are contributing to the food supply of Great Britain and other nations. Shipping space is the bottleneck, so foods that take as little space as possible are wanted. Dried milk, dried eggs, cheese, and lard are livestock products that meet this demand.

USES THAT CAN BE MADE OF DATA CONCERNING FEED UTILIZATION

One of the principal uses that can be made of average feed-utilization data is in estimating the feed requirements for future quantities of livestock products or numbers of livestock in the United States. The program for increasing quantities of livestock products for war purposes is an example. The unit feed requirements given in tables 37 and 38 are intended for use in estimating feed requirements at the national level and must be adjusted if they are to be used in estimating feed requirements for a region, State, or smaller area than the United States, as these requirements vary considerably in different parts of the country. To be most useful the feed requirements are shown per unit of product or per head of livestock. These are given in table 38 for the period 1938-40, and in table 37 for 1929-33. The production figures and livestock numbers used in computing unit require-

ments are those reported by the Department of Agriculture, with the exception of production of beef and production of meat from chickens and turkeys, and the 1910-23 figures of milk production. These are estimates made by the writer.

Corn is given in tables 37 and 38 in two ways: All corn including corn in silage, and corn excluding corn in silage. The figure, corn including corn in silage, is the figure used in the official estimates of the Department for the production of corn (production in grain equivalent on the entire acreage, 1941 Agricultural Statistics, p. 48). The figures for corn excluding silage are derived from tentative tabulations supplied by the Bureau and are not official estimates of the Department. They are used here because this is the way the corn is generally used by farmers.

TABLE 37.—*Feed consumed by livestock by classes, United States, average annual 1929-33¹*

¹ The data are for the 5-year period from July 1, 1928 to June 30, 1933. See tables 3 to 7 for the total quantities of feed to which these per unit quantities relate. The quantities of feed given in this table include grain or other concentrates fed as such or used in mixed feeds. The number of livestock and the production of livestock products to which these quantities of feed relate are the official estimates of the Department shown in tables 10 and 11, except for the live weight of beef cattle and the live weight of chickens and turkeys which were estimated by the writer.

² Average number of milk cows during year, heifers not freshened excluded.

³ Includes feed for young dairy cattle and dairy bulls as well as dairy cows.

⁴ Includes feed for dairy heifers, young dairy cattle, dairy bulls as well as feed for all beef cattle. The official estimates of the Department divide cattle into 2 classes, milk cows and all other cattle. There is no official estimate of "beef cattle" as such.

⁵ For each 100 pounds of live weight of sheep and lambs produced, 20 pounds of wool were produced from the same feed.

⁶ The feed for the average hen for a year would be about 9 percent larger than per hen Jan. 1 as the number of hens and pullets Jan. 1 is about 110 percent of the average number during the year.

⁷ Includes broilers.

⁸ All corn including the corn in silage.

⁹ Includes corn fed as grain, corn hogged- or grazed-off, corn used in mixed feeds but not corn in silage.

¹⁰ See tables 3, 5, and 6 for feeds included here. Includes commercial feed materials, such as the oil meals, tankage, and milk products, millfeeds and peanuts hogged-off, cottonseed fed as such, skim milk (dry basis), potations, etc.

¹¹ Includes sorghum forage, corn stover, straw, and cottonseed hulls. Bedding not included.

¹² Not estimated for 1929-33. See table 38 for 1938-40 estimates.

TABLE 38.—Feed consumed by livestock, by classes, United States average annual 1938-40¹

Item	By cattle				By sheep				By horses and mules						
	Milk cows only		All dairy cattle ³		All cattle other than milk cows ⁴		All beef cattle		All sheep and lambs		Ewes only		All horses and mules		
	Per 100 pounds milk	Per milk cow (average for the year) ²	Per 100 pounds milk	Per milk cow (average for the year) ²	Per 100 pounds live weight produced	Per head Jan. 1	Per 100 pounds live weight produced	Per head Jan. 1	Beef cows only, per head Jan. 1	Per 100 pounds live weight produced	Per head Jan. 1	Per head Jan. 1	Per head Jan. 1	Horses and mules 2 years old and over only, per head Jan. 1	
Feed:															
Corn ⁵ -----															
Corn 6-----	14.3	634	18.8	794	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	
Oats-----	8.9	374	11.6	492	110	319	150	1,011	77	36	14	13	729	813	
Oats-----	6.2	265	9.1	385	331	403	94	39	22	8	5	687	736	745	
Other grain-----	3.2	136	3.5	142	147	10	36	17	116	6	5	33	37	36	
All grain ¹⁰ -----	18.3	775	24.1	1,024	1,072	129	449	180	1,217	74	28	1,449	1,616	1,582	
Other concentrates ¹¹ -----	9.2	387	10.9	461	483	58	202	95	640	145	5	65	73	73	
All concentrates ¹⁰ -----	27.5	1,162	35.1	1,217	1,485	1,555	187	651	275	1,857	289	79	25	1,514	
Silage (corn)-----	43	1,922	56	2,408	1,411	488	88	297	597	249	6	30	25	1,655	
Hay-----	61	2,624	74	2,748	84	3,589	3,759	370	1,283	426	2,874	400	183	2,483	
Other dry roughage ¹² -----	13	588	24	991	1,037	2,337	819	349	2,356	1,164	147	55	53	2,771	
Pasture (corn equivalent) ¹³ -----	44.0	1,888	64.1	2,747	2,873	508	765	779	5,259	2,633	1,242	485	834	3,930	
Feed units: ¹⁴ -----															
Grain ¹⁰ -----	17.4	739	23.5	974	1,020	126	437	177	1,203	166	70	27	24	1,365	
All concentrates ¹⁰ -----	26.8	1,134	34.9	1,188	1,488	1,527	679	291	1,971	309	76	29	25	1,330	
Pasture-----	44.0	1,888	64.1	1,980	64.1	2,747	873	508	1,765	2,529	2,633	1,242	485	534	
Other roughage ¹⁵ -----	39.0	1,721	57.3	1,803	57.3	2,495	600	261	905	2,060	963	1,027	83	97	
All feed-----	110.6	4,743	4.973	156.3	6,700	7,000	965	3,349	9,290	3,905	1,525	597	4,294	4,792	4,528

By hogs		By chickens				By turkeys			
		Laying flocks		Raising chickens ³		Commercial broilers ¹⁶		Excluding breeding flock	
Per 100 pounds live weight produced	Per head Jan. 1	All chickens per head Jan. 1 ⁶	Per 100 eggs produced	Per hen and pullet Jan. 1 ⁷	Per chick-en produced	Per 100 pounds live weight chickens produced	Per head	Per 100 pounds live weight	Per 100 pounds live weight turkey produced
Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Feed:									
Corn	341	1,025	788	43.8	29.1	30.2	122	3.5	35
Oats	22	66	50	7.0	3.6	2.6	65	1.6	13
Other grain	26	78	60	17.1	12.5	13.0	55	1.6	79
All grain	389	1,169	898	68.0	45.3	47.0	456	232	17
Other concentrates	36	107	83	14.6	12.8	13.2	48	176	65
All concentrates	424	1,276	981	82.5	58.0	60.2	504	408	7
Pasture (corn equivalent)	24	72	55	4	4	2	50	11.8	72
Feed units:									
Grain	385	1,159	890	67	45	46	446	224	6.4
All concentrates	435	1,308	1,005	88	63	66	516	481	13.8
Pasture	30	120	92	4	4	2	50	56	66
All feed	465	1,428	1,097	92	67	70	566	481	73

¹ The data are for the 3-year period July 1, 1937, to June 30, 1940. See tables 3 to 7 for the total quantities of feed to which these per unit quantities relate. The quantities of feed given in this table include grains or other concentrates fed as such or used in mixed feeds. The number of livestock and the production of livestock products to which these quantities of feed relate are the official estimates of the Department shown in tables 12 and 10, except for the live weight of beef cattle, and the live weight of chickens, commercial broilers, and turkeys which were estimated by the author.

² Average number of milk cows during year, heifers not freshened excluded. This is a slightly smaller number than the number January 1.

³ Includes feed for young dairy cattle and dairy bulls as well as dairy cows.

⁴ Includes feed for dairy heifers, young dairy cattle, dairy bulls, as well as feed for all beef cattle. The official estimates of the Department divide cattle into 2 classes, milk cows and all other cattle. There is no official estimate of "beef cattle" as such.

⁵ For each 100 pounds live weight of sheep and lambs produced, 20 pounds of wool was produced from the same feed.

⁶ Excludes feed for commercial broilers.

⁷ The feed for the average hen for a year would be about 9 percent larger than per hen Jan. 1 as the number of hens and pullets Jan. 1 is about 110 percent of the average number during the year.

⁸ Feed for chickens raised, excluding commercial broilers.

⁹ All corn, including the corn in silage.

¹⁰ Includes corn fed as grain, corn hogged- or grazed-off, corn used in mixed feeds, but not the corn in silage.

¹¹ See tables 3, 5, and 6 for feeds included here. Includes commercial feed materials, such as the oil meals, tankage and milk products, milifeeds and peanuts hogged-off, cottonseed fed as such, skim milk (dry basis), potatoe, etc.

¹² Includes sorghum forage, corn stover, straw, and cottonseed hulls. Bedding not included.

¹³ Feed value of pasture and grazing expressed in pounds of corn or feed units. Includes feed from all range lands, farm pastures, or other sources grazed by livestock.

¹⁴ Feed value of each kind of feed expressed in pounds of corn.

¹⁵ Includes silage.

¹⁶ Estimated average weight 2.89 pounds per head. It takes about 6 pounds of feed for a 2-pound broiler, 9 pounds for a 2½-pound broiler, and 12 pounds for a 3-pound broiler.

The term "other grain" includes barley, wheat, and other grains fed or used in mixed feeds (table 3). Other concentrates include the feeds shown in tables 5 and 6. Not all of these are reported by the Bureau. Other dry roughage fed was estimated by the writer, as no production data are available. Official Department estimates are available for oats, hay, and silage.

ESTIMATING THE GRAIN AND OTHER CONCENTRATES REQUIRED FOR LIVESTOCK IN THE UNITED STATES

In determining goals for milk, meat, poultry, and other livestock products it is necessary to estimate how much feed will be required for the total volume of livestock production in a year so as to provide a sufficient acreage of feed crops. As in general 1 year's crop produces the following year's livestock products it is necessary to estimate the livestock requirements for 1944 in order to know what acreage to plant in 1943.

One way to estimate the feed required for a given volume of livestock production is to determine the number of animal units represented by the required number of livestock or volume of production. The factors given in column 2 of table 39 may be used for this purpose. The factors per unit of production are more satisfactory than those per head because they take into account expected changes in pro-

TABLE 39.—*Factors for estimating the animal units in a year from the number of livestock on farms January 1 or from the annual production of each livestock product*¹

Livestock on farms	Unit	Basis on which livestock are compared			
		Use of all feed	Use of feed grains and other concentrates		Use of hay, silage, pasture, and other roughage
			Including corn in silage	Excluding corn in silage	
Number January 1:					
Milk cows	Number	1.0	1.0	1.0	1.0
Other cattle	Number	.70	.55	.57	.75
All sheep and lambs	Number	.125	.027	.026	.16
Hogs	Number	.30	.91	1.09	.03
Chickens ²	Number	.019	.060	.072	.001
Turkeys	Number	.076	.23	.28	.009
All horses and mules	Number	.95	1.11	1.32	.79
Horses and mules 2 years old and over	Number	1.0	1.21	1.44	.82
Colts	Number	.48	.20	.25	.56
Annual production:					
Milk	100 pounds	.0236	.0236	.0236	.0236
Cattle and calves	100 pounds live weight	.203	.157	.187	.213
Hogs	100 pounds live weight	.098	.318	.378	.008
Eggs	100 eggs	.014	.045	.053	.001
Chickens produced	Number	.0046	.0112	.0170	.0005
Turkeys produced	Number	.017	.051	.060	.002
Broilers produced	Number	.0029	.0086	.0103	
Hogs slaughtered	Number	.231	.728	.866	.025

¹ The factors in this table compare roughly for the United States as a whole each of the livestock enterprises with milk cows in the use of all feed, concentrates, or roughage for a year. The number of livestock January 1 may be used to estimate the animal units or the annual production may be used. The production will generally give a more accurate comparison than the numbers January 1 but has the disadvantage of not being available so soon. The factors given for the number of livestock January 1 are applicable over a long period except for horses and mules 2 years old and over. The data in the table for horses and mules 2 years old and over apply from 1930 to 1942. Previous to 1930 use the following factors for horses and mules in the order given in the table: 1.1, 1.3, 1.7, .75. The factors for annual production are applicable only in recent years.

² Allows for both laying flocks and chickens raised.

duction per animal. The following factors may be multiplied by the required production or number of animals to give the annual number of concentrate-consuming animal units, milk 0.0236 per 100 pounds; cattle and calves, 0.157 per 100 pounds live weight produced; hogs 0.318 per 100 pounds live weight products; eggs 0.045 per 100 eggs produced; chickens raised, 0.0142 per head produced; broilers raised, 0.0086 per head produced; turkeys raised, 0.051 per head produced; sheep and lambs, 0.027 per head Jan. 1; horses and mules, 1.11 per head Jan. 1.

The following computations will illustrate the animal units represented by the production assumed to be needed in 1943:

	<i>Animal Units</i>
Milk, 122,000 million pounds $\times 0.0236$	28,792,000
Cattle and calves 16,825 million pounds $\times 0.157$	26,415,000
Hogs, 27,464 million pounds $\times 0.317$	87,335,000
Eggs, 57,360 million eggs $\times 0.045$	25,812,000
Chickens, 762,000 thousand head produced $\times 0.0142$	10,820,000
Broilers, 400,000 thousand head produced $\times 0.0086$	3,440,000
Turkeys, 38,400 thousand head produced $\times 0.051$	1,958,000
Sheep and lambs, 55,500 thousand head on Jan. 1 $\times 0.027$	1,498,000
Horses and mules, 13,200 thousand head on Jan. 1 $\times 1.11$	14,652,000

Total livestock on farms	200,722,000
--------------------------	-------------

The above livestock thus represents 200.7 million animal units. This is the livestock on farms. In addition there is a considerable number of livestock in cities that will be fed from the total feed supply. The number of concentrate-consuming animal units in cities is estimated at 4,300,000 giving a total number of animal units of 205.0 million. This number, multiplied by the estimated quantity of feed per animal unit, will give the quantity of feed needed for this number of animal units in a year.

The feed per animal unit may perhaps best be estimated by taking the feed disappearance per animal unit in the preceding year unless there are reasons for taking some other figure. The number of animal units is calculated in a similar way for the preceding year. The feed disappearance is also calculated for a 12-month period, taking into account changes in stocks, production of the feed grains, quantity of wheat fed, quantity of commercial feeds, etc. It is important that exactly the same classes of feeds be used in the year used as the base as in the year for which the estimate is to be made. If it was found that 0.661 ton of all feed were used per animal unit in 1942, then the total feed required in 1943 at the same rate per animal unit would be 205.0 million animal units multiplied by 0.661 ton or 135.5 million tons. Changes can be made in this estimate to account for unusual conditions such as a large increase in protein concentrates or for unusually heavy feeding of milk cows or other conditions.

The above method will give a fairly close approximation of the feed required for a year. If the factors given in table 39 for numbers of livestock are used instead of *production* factors, the answer may not be so accurate as the production factors allow for some variation in feed due to variation in production per animal. If production factors are to be used, it is necessary to have or to estimate the production for the year for which feed consumption is to be estimated as well as for the base year. If the period is other than a calendar year it will be

desirable to estimate the production for this period. This is especially true of hogs as they consume a large percentage of the feed grains.

OTHER USES FOR DATA

These data may also be used as a basis for converting the number or the production of livestock into animal units. An animal unit is a device for combining all kinds of livestock in one figure. The average dairy cow that consumes approximately 5,000 feed units in a year is an animal unit, and all other classes of livestock have been converted to animal units according to the quantity of feed used in a year. The comparison of different classes and ages of animals with a milk cow is given in table 40 for different classes of feed and for all feed. In tables 11 and 14 are found the total animal units represented by each class of livestock, using all feed consumed as the base, and for all livestock combined, using all feed, concentrates, and roughage as bases.

TABLE 40.—*Animal units: Factors for converting numbers of livestock into units of equivalent feed consumption of different classes of feeds, average, United States*¹

Class of animal	Class of feed			
	Feed grains ²	All concentrates	Roughage and pasture	All feed
<i>Stock animals, per head</i>				
Milk cow, average number for the year	1.00	1.00	1.00	1.00
Dairy heifer, 2 years old	.53	.46	.81	.72
Dairy heifer, yearling	.37	.29	.48	.43
Dairy bull	.97	.80	.82	.82
Beef cow	.21	.26	.94	.79
Beef heifer, 2 years old	.13	.23	.81	.67
Beef heifer, yearling	.06	.08	.47	.38
Beef steer, yearling	.06	.08	.47	.38
Beef steer, 2 years old	.10	.13	.79	.64
Beef bull	.19	.17	1.04	.84
Horse or mule, over 2 years old	1.97	1.35	.77	.91
Colt, 2 years old	.78	.50	.67	.63
Colt, yearling	.00	.00	.43	.33
Ewe or ram	.04	.02	.17	.13
Lamb, yearling	.00	.00	.05	.05
Brood sow	1.65	1.18	.30	.30
Hen or pullet, per 100 head, average number for the year ³	6.48	6.06	.10	1.53
<i>Fattening animals, per head</i>				
Steer, 250 pounds gain in weight	1.80	1.68	.30	.63
Lamb, 25-30 pounds gain in weight	.11	.08	.02	.03
Hog, from weaning to market weight (225 pounds)	1.16	.83	.01	.20
Chicken, from baby chicks to market weight, per 100 head	2.32	1.68	.05	.44
Turkeys, to market weight, per 100 head	7.36	5.56	.17	1.47
<i>Fattening animals, per 100 pounds gain or produced</i>				
Steer per 100 pounds gain	.72	.67	.12	.25
Lamb per 100 pounds gain	.46	.29	.08	.12
Hog per 100 pounds produced ⁴	.417	.366	.008	.094
Hog per 100 pounds gain, weaning to marketing	.452	.333	.006	.086

¹ The data in this table are based on 1938-40 rates of feed consumption. The purpose of this table is to provide factors for combining different kinds of livestock into units of equivalent feed consumption, called an animal or feed-consuming unit. The average milk cow producing about 4,500 pounds of milk and consuming 4,971 feed units of all feed is taken as the base. The milk cow is taken as the base for 3 groupings of feed—feed grains, all concentrates, roughage and pasture. The average milk cow uses 774 feed units of feed grain, 1,188 feed units of all concentrates, and 3,733 feed units of roughage and pasture. The data given apply to average livestock for the United States and would not necessarily apply to a particular State or region which may vary widely from the average in the kind and quantity of feed consumed. Beef cattle, for instance, vary greatly in the kind and quantity of feed consumed in different parts of the United States. For data on conversion factors for estimating the total annual animal units in the United States from the number of livestock Jan. 1, see table 39.

² Corn in silage is not included in feed grains or all concentrates. Silage is included under roughage.

³ Feed for laying flock only and not for raising chickens.

⁴ Includes entire production process including breeding herd.

The "average" utilization data given in this report can be used for comparing the feed used in producing milk, eggs, beef, etc. in feed units. A feed unit is a device for combining all kinds of feeds. It is a pound of corn or the equivalent of corn in feeding value expressed in other kinds of feeds. Corn is used as it is the principal feed crop.

Total digestible nutrients could be used for this purpose but with certain disadvantages. This device commonly puts too high a value on roughages except when used only for maintenance of livestock. It is better suited for comparing the feeding value of similar feeds than for comparing those widely different. It is generally better for evaluating feeds for "maintenance" purposes than for "production" purposes. It does not give any additional value to protein feeds fed in limited quantities.

The feed unit, although more or less arbitrary, was used for combining all kinds of feeds into a single figure. The feed obtained from pasture or range is estimated in table 41. In table 38 the feed units used in the production of each livestock product are given. In table 42 the estimated feed units required for animals of different ages are shown. In table 40 the factors are given for converting numbers of livestock into units of equivalent feed consumption.

TABLE 41.—*Estimated value of a season's grazing in feed units (pounds of corn) for different kinds of livestock*

Kind of livestock	Number of days grazed ¹	Grazing per head per day (1 cow = 100 percent)	Grazing unit days per year ²	Grazing units per head if dairy cow = 1.0	Value of grazing
		Number	Percent	Number	
Milk cow	180	100	180	1.0	³ 1,980
Dairy heifer, 2 years old	180	86	154	.86	1,703
Dairy heifer, yearling	180	48	86	.48	950
Dairy bull	100	103	103	.57	1,129
Beef cow	252	95	239	1.33	2,633
Beef heifer, 2 years old	252	86	216	1.20	2,376
Beef heifer, yearling	252	48	121	.67	1,327
Steer, yearling	252	48	121	.67	1,327
Steer, 2 years old	252	86	216	1.20	2,376
Beef bull	200	102	205	1.14	2,257
Fattening steer	60	83	50	.28	554
Work horse or mule	130	109	142	.79	1,564
Colt, 2 years old	200	76	153	.85	1,683
Colt, yearling	200	47	95	.53	1,049
Ewe or ram	320	15	49	.27	535
Lamb, yearling	320	6	19	.11	198
Fattening lamb	30	12	3	.017	34
Sow	100	11	11	.06	119
Pig raised	130	3.6	4.7	.03	59
100 chickens on hand Jan. 1	90	.35	32	.18	356
100 chickens raised	90	.2	18	.1	198
100 turkeys raised	120	.5	60	.33	653

¹ It is assumed that the average milk cow in the United States weighs 850 pounds and produces 4,490 pounds of milk in a year. The pounds of digestible nutrients "recommended for good cows under usual conditions" and "minimum allowance advised" according to Morrison's feeding standards may be computed as follows:

	Recommended for good cows under usual conditions	Minimum allowance advised
Maintenance 365 days	× 6.88 = 2,511	× 6.08 = 2,219
Calf (estimated)	380	380
Milk 4,490 pounds	× 324 = 1,455	× 307 = 1,378

Total pounds digestible nutrients..... 4,346 3,977

"Minimum allowance advised" was assumed to be about what the average cow receives in a year or 3,977 total digestible nutrients or 4,971 feed units. The feed units obtained by the average cow from concentrates are 1,188; from roughage, other than pasture, 1,803 (table 38), leaving 1,980 feed units from pasture in a year. This is 11 feed units (8.8 total digestible nutrients) a day for 180 days of pasture.

² The grazing obtained by the average milk cow in 1 day is a grazing-unit day.

³ Estimated average for the United States. Cattle and sheep graze more days out of the year in the West than in the East and longer in the South than in the North.

Sometimes the approximate quantity of grain feed or concentrates required to produce a given quantity of a particular livestock or product is wanted. Table 43 has been prepared for this purpose. The quantity of product that can be expected from 1,000 pounds of concentrates is also given. Estimates for representative kinds of production are included.

TABLE 42.—*Feed units from different sources used annually by different kinds and ages of animals, average, United States 1938-40*¹

Livestock	Grain	All concentrates	Roughage except pasture	Pasture	All feed
	Feed units	Feed units	Feed units	Feed units	Feed units
Milk cow, average number for year	774	1,188	1,803	1,980	4,971
Milk cow, per head Jan. 1	739	1,134	1,721	1,888	4,743
Dairy heifer, 2 years old	410	546	1,354	1,703	3,603
Dairy heifer, yearling	286	344	856	950	2,150
Dairy bull	750	950	2,000	1,129	4,079
Beef cow	160	309	963	2,633	3,905
Beef heifer, 2 years old	100	275	700	2,376	3,351
Beef heifer, yearling	50	100	450	1,327	1,877
Steer, yearling	50	100	450	1,327	1,877
Steer, 2 years old	75	150	650	2,376	3,176
Beef bull	150	200	1,700	2,257	4,157
Fattening steer	1,400	2,000	600	554	3,154
Per 100 pounds gain	560	800	240	222	1,262
Work horse or mule	1,528	1,600	1,400	1,500	4,500
Colt, 2 years old	600	600	855	1,683	3,138
Colt, yearling			590	1,049	1,639
Ewe or ram	24	25	97	535	657
Lamb, yearling			43	198	241
Fattening lamb	76	84	40	34	158
Per 100 pounds gain	304	336	160	128	624
Sow per year	1,275	1,400		119	1,519
Pig raised, weaning to 225 pounds	900	988		59	1,047
100 hens and pullets average number for the year ²	5,014	7,200		430	7,630
100 chickens produced	1,800	2,000		200	2,200
100 turkeys produced	5,700	6,600		700	7,300

¹ A feed unit is the equivalent in feeding value of 1 pound of corn. The data apply to the period July 1, 1937 to June 30, 1940.

² The feed for the average hen for a year is about 9 percent larger than per hen Jan. 1 as the number of hens and pullets on Jan. 1 is about 110 percent of the average number during the year.

TABLE 43.—*Concentrates used in producing livestock and livestock products, and the livestock production expected from feeding 1,000 pounds of concentrates under specified conditions*¹

Product	Area or kind of production to which data apply	Unit of livestock production	Concen- trates required per unit of production ²	Livestock production from 1,000 pounds of concen- trates ²
Milk	(a) Average cow producing 4,500 pounds milk. (b) Cows in commercial dairy herds averaging 6,000 to 7,000 pounds milk per cow per year.	100 pounds----- 100 pounds-----	Pounds ³ 27.5 ³ 30	Pounds ⁴ 3,636 ⁴ 3,333
Hogs	Average conditions ⁵ Gain on hogs from weaning to market- ing ⁶ corn belt.	100 pounds live weight.. 100 pounds gain in weight.	424 400	235 250
Eggs	(a) Average laying flock ⁷ (b) Farm flock, Middle West, produc- ing 108 eggs per layer. ⁷ (c) Commercial flock producing 180 eggs per layer. ⁷	100 dozen----- 100 dozen----- 100 dozen-----	700 900 578	Dozen 143 111 173
Chickens	Raising chickens from baby chicks to 3½-5 pounds under average condi- tions.	100 pounds live weight..	504	Pounds 198
Broilers	Average conditions ⁸	100 pounds live weight..	408	245
Turkeys	Average conditions ⁹	100 pounds live weight..	470	213
Beef	Cattle fattening ¹⁰ (a) Calves 350-800 pounds. (b) Yearlings 600-950 pounds. (c) 2-year-old steers 750-1,100 pounds.	100 pounds gain----- 100 pounds gain----- 100 pounds gain----- 100 pounds beef produced	575 685 750 300	174 146 133 333
Beef	Cattle raising and fattening beef herd in Corn Belt; producing and fattening calves and selling at 800 pounds. ¹¹	100 pounds gain-----	450	222
Lambs	Fattening lambs in Corn Belt from 55 pounds to 80 pounds.	Work for a year-----	1,700	—
Horses and mules	Average ¹²			

¹ This table is intended to provide a way of estimating the quantity of grain or other concentrates required for given volume of livestock or livestock product or the livestock production that may be expected from a given quantity of concentrates. The different feed grains and other feed materials are substituted for each other in actual feeding. They differ from each other in nutrient content and in feeding value for different classes of livestock as shown in table 8. However, for a rough calculation the feed grains available for feed may be added together and the livestock production may be estimated from the data in this table which are only approximate and may vary considerably in different areas.

² The table assumes that hay and pasture is used by roughage-consuming livestock in the usual quantities in addition to the concentrates shown.

³ Does not include corn in silage. The 27.5 and 30 pounds per 100 pounds of milk is for milk cows only and does not include feed fed to other dairy cattle.

⁴ Also fed silage and legume hay and pasture.

⁵ Includes feed for breeding herd as well as fattening hogs.

⁶ Excludes feed for breeding herd.

⁷ Feed for laying flock only and not for raising chickens.

⁸ Broilers weighing 2.9 pounds.

⁹ Includes allowance for feed for breeding flock as well as for raising turkeys.

¹⁰ Fed corn and alfalfa but not silage or pasture. Grade of cattle, Medium to Good.

¹¹ Includes feed for entire herd of cows and calves. Cull cows sold included in pounds beef produced.

¹² Wide variation in grain fed in different areas. This is the estimated average for the United States.

